Wisconsin Component Manual
AdvanTex® Treatment Systems

Orenco Systems®
Incorporated
1-800-348-9843

Contents

Overview
AdvanTex® Treatment Systems

Orenco Systems® Incorporated
1-800-348-9843

Orenco's AdvanTex® Treatment Systems are an innovative technology for onsite treatment of wastewater. The heart of the System is the AdvanTex filter, a sturdy, watertight fiberglass basin filled with an engineered textile material. This lightweight, highly absorbent textile material treats a tremendous amount of wastewater in a small space. That's because textile has a very large surface area for biological breakdown of wastewater components – about five times greater than that of an equivalent volume of sand. Yet the AdvanTex filter has a very small footprint.

System Performance

Orenco Systems® has been researching, designing, testing, and selling a variety of textile filters for nearly a decade. About 20,000 textile filters have been installed throughout the United States and Canada, on sites ranging from federal demonstration projects to university testing facilities, single-family homes, commercial properties, and community systems.

Unlike other wastewater treatment technologies, the AdvanTex Treatment System provides consistent, reliable wastewater treatment, even during "peak flow" conditions. The AdvanTex Treatment System includes a processing tank and a control panel with a programmable dosing timer. So it discharges small amounts of treated wastewater, regularly, throughout the day.

AdvanTex treats residential-strength waste to better than "secondary" standards. Effluent can be used for drip or subsurface irrigation, or discharged to shallow, inconspicuous trenches. It can also be discharged to fine-grained polishing filters for coliform removal and water reuse.

Third-Party Performance Verification

AdvanTex Treatment Systems have undergone lengthy performance testing to ANSI and NSF/ANSI standards. This third party testing (NSF Final Report, April 2002) of treatment performance recorded a maximum 30-day arithmetic mean of 8 mg/L for $CBOD_5$ and 6 mg/L for suspended solids. Over the six-month course of the evaluation, the average effluent $CBOD_5$ was 5 mg/L, and the average effluent suspended solids was 4 mg/L.

System Benefits

Significantly smaller land area is required for the AdvanTex Treatment System than is required for sand and gravel filters. That's because textile has demonstrated the capacity to support microbial populations that can treat filtered processing tank effluent at greater hydraulic loading rates. In fact, loading rates for AdvanTex Treatment Systems are typically 5-20 times higher than for sand filters. In addition, reductions in drainfield size are often permitted with AdvanTex Treatment Systems. Moreover, textile is lightweight, making it ideal for prepackaging and shipping, which simplifies installation and reduces costs.

Applications

The AdvanTex Treatment System is ideal for...

- New construction
- System upgrades and repairs
- Pretreatment of moderately high-strength waste
- Wherever typical secondary treatment standards suffice

AdvanTex®-AX Filters Overview (continued)

System Operation and Maintenance

AdvanTex is easy to service, easy to clean, and generates virtually no troublesome activated sludge. Like most advanced technologies, the AdvanTex Treatment System requires regular maintenance. As a condition of warranty, property owners must purchase a service contract from a certified third party provider.

The AdvanTex Treatment System comes standard with a VeriComm® telemetry control panel with a Web-based monitoring system, supervised by the System's service provider*. Alarm notifications are automatically sent to the service provider's e-mail capable device. Messages are resent until the condition has been cleared. As a back-up, the VeriComm control panel also has an audible alarm. And the System is sized to allow for a minimum of 24 hours of wastewater storage (at average daily flows). That means an operator can provide service to the system during normal working hours, regardless of when an alarm occurs.

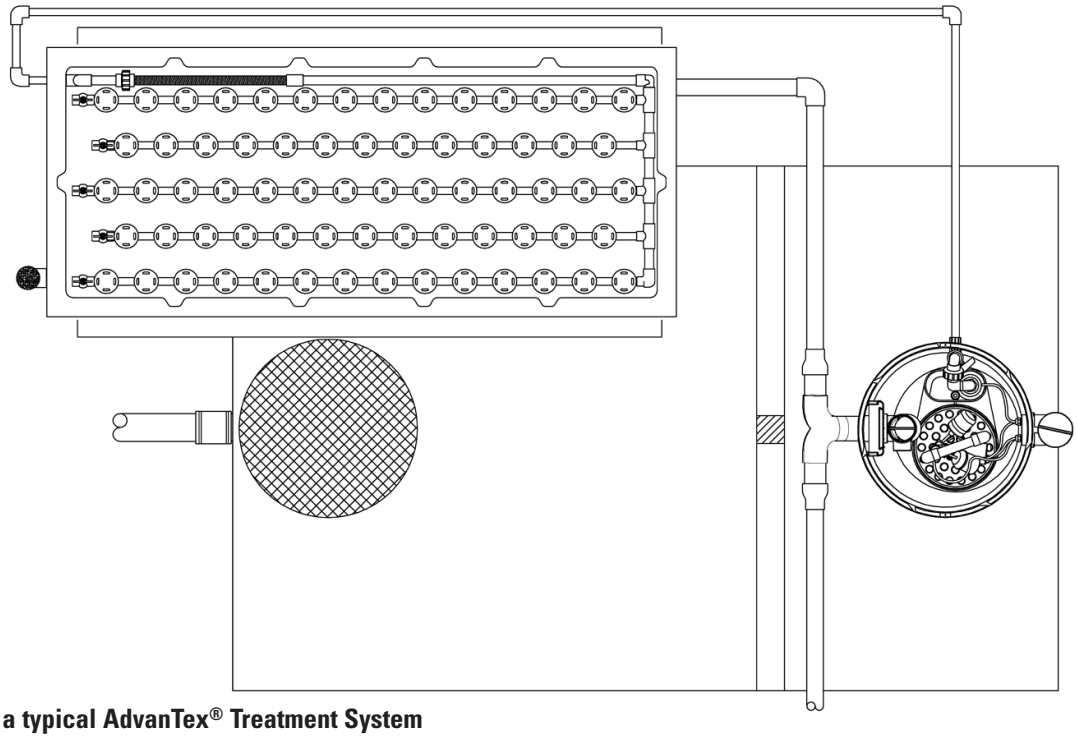
The AdvanTex System's pumps typically run 30-60 minutes per day, so AdvanTex uses very little power . . . an average of $1.80-4.80 per month (based on the national average of ten cents per kilowatt hour). Compare that to power costs of up to $30-$60 per month for many "activated sludge" aerobic treatment units.

Treatment Methodology

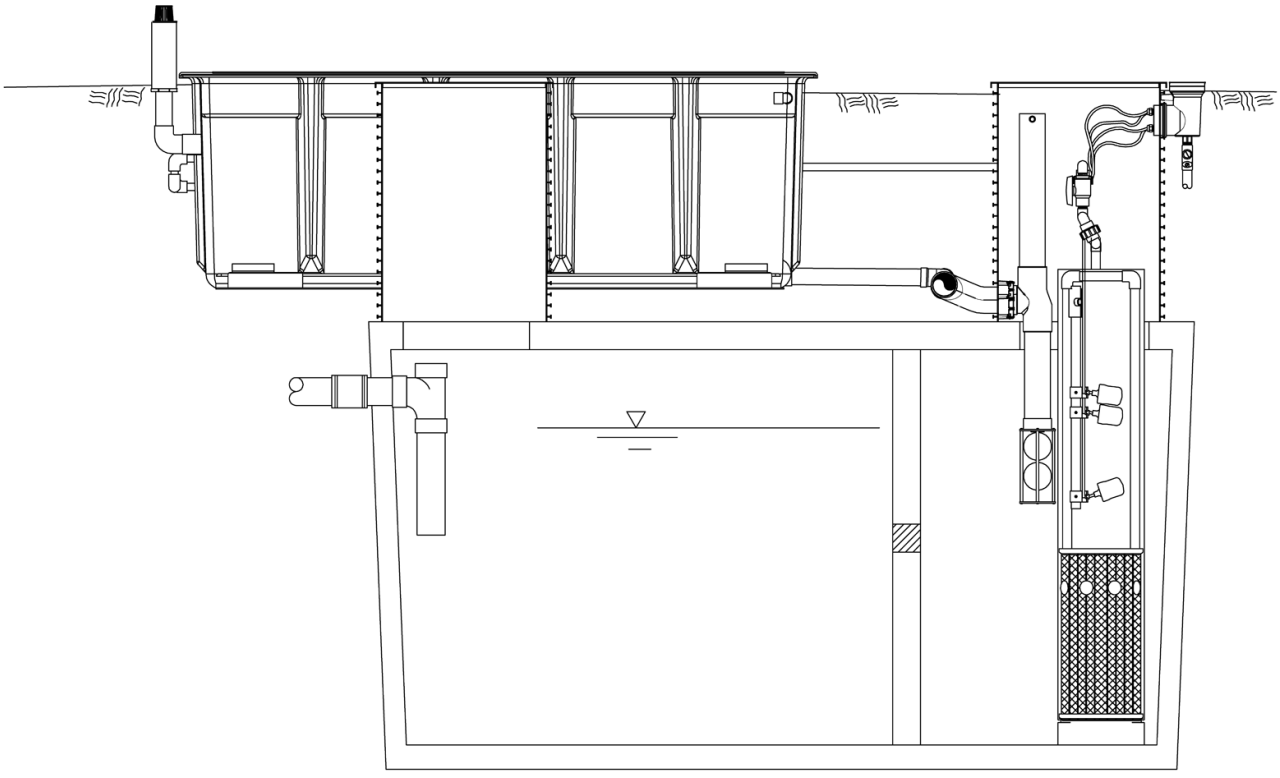
The AdvanTex Treatment System works just like a recirculating sand filter: a reliable, proven technology that Orenco's engineers have helped to perfect over the past 25 years. While the treatment process is similar, the proprietary treatment module is more efficient.

In an AdvanTex Treatment System, wastewater percolates through the textile media, whose complex fiber structure provides tremendous water-holding capacity and offers an extremely large surface area for biomass attachment. A visible biological film normally develops on the filter medium within a few days. BOD5 and TSS reductions occur almost immediately.

** MVP digital programmable panels are available as an option in some markets.*



Top view of a typical AdvanTex® Treatment System



Side view of a typical AdvanTex Treatment System

FOR ADVANCED WASTEWATER TREATMENT

Introducing AdvanTex® AX20-RT

Orenco Systems® Incorporated
800-348-9843

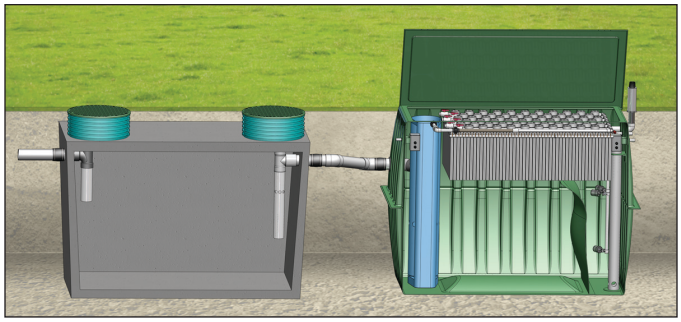
"Performs like AdvanTex, Installs like a Tank"

AdvanTex® - Quality Treatment, at a Competitive Price

Orenco's AdvanTex AX20-RT is a completely pre-packaged "plug & play" AX20 that installs as easily as a septic tank. Its simplified design reduces costs for excavation, installation, and O&M, giving your residential customers AdvanTex-quality wastewater treatment at a competitive price.

3-in-1, Pre-plumbed System

The AX20-RT combines the recirc, treatment, and discharge modules of a standard AX20 into a single, shallowly-buried unit. What's more, there's no recirculating splitter valve to mess with. Instead, a patented baffle with one-way valve performs this function automatically. Plus all interior components are installed and adjusted at the factory. Just hook it up to a tank and go! Easier install, fewer call-backs.



Clear, Odorless, Re-Usable Effluent

The AX20-RT produces the same, great, "re-use" quality effluent produced by all AdvanTex systems: BOD and TSS of 10 mg/L or less. (In fact, it has been approved by NSF as an AX20-equivalent.) So the treated effluent can be re-used for sub-surface irrigation. A responsible, green solution to household water and wastewater needs!

Low Power Costs, Low Maintenance Costs

No blowers. No odors. The AX20-RT is passively vented and uses less than $2/mo in electricity. And it's easy to maintain with an annual service call. Cleanable filters and media, 20-year pumps. Your customers will thank you.

Reduces Nitrogen Too

Like all AdvanTex Treatment Systems, the AX20-RT reduces nitrogen by 60-70% naturally, or by more than 90% with supplemental processing.

Compact Footprint, Shallow-Bury

The AX20-RT recirculates, treats, and discharges high quality effluent out of a unit that is only 6 ft high and a total of 20 sq ft. And it can be shallowly buried right next to a watertight tank. So it's perfect for small sites and sites with clay or rocky soils.

Ideal for Repair/Replacement of Failing Systems

Many existing septic systems are at the end of their useful life. The AX20-RT can replace a failing system in a fraction of the space. And, if the existing tank is re-useable, at a fraction of the cost.

Comes with 24/7 Remote Monitoring

The AX20-RT comes standard with Orenco's VeriComm® Remote Telemetry Control Panel and Monitoring System for affordable, round-the-clock supervision and control. (Non-telemetry panels also available.)

Standard Models and Configurations

See back. ——►

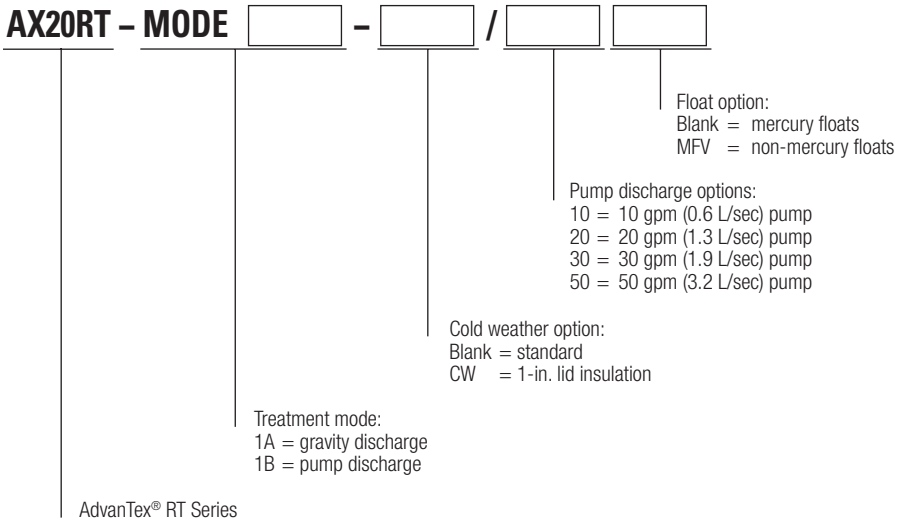
AdvanTex® AX20-RT (continued)

Standard Models and Configurations

There is an AX20-RT for both gravity and pump discharge and for cold weather applications. Following is a list of standard models.

- AX20RT-MODE1A
- AX20RT-MODE1A-CW
- AX20RT-MODE1B/10
- AX20RT-MODE1B-CW/10
- AX20RT-MODE1B/30
- AX20RT-MODE1B-CW/30

Other models are available. See nomenclature, below.



Call Orenco at 1-800-348-9843 for an AX20-RT design package or for the name of your local AdvanTex Dealer.

AdvanTex® Design Criteria

Orenco Systems® Incorporated
800-348-9843

For Single-Family Home Applications — AX20 Treatment Unit

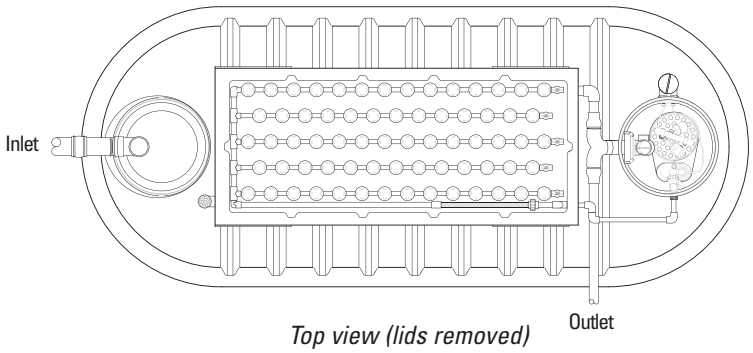
System Description and Treatment Process

The AdvanTex® Treatment System is a multiple-pass, packed-bed aerobic wastewater treatment system specifically designed and engineered for long-term processing of residential strength wastewater. The treatment media is an engineered textile, which has an extremely high void capacity, moisture-holding capacity, and surface area per unit volume. Consequently, AdvanTex Treatment Systems are capable of processing residential strength wastewater to better than "secondary standards" (see Figure 3, page 3).

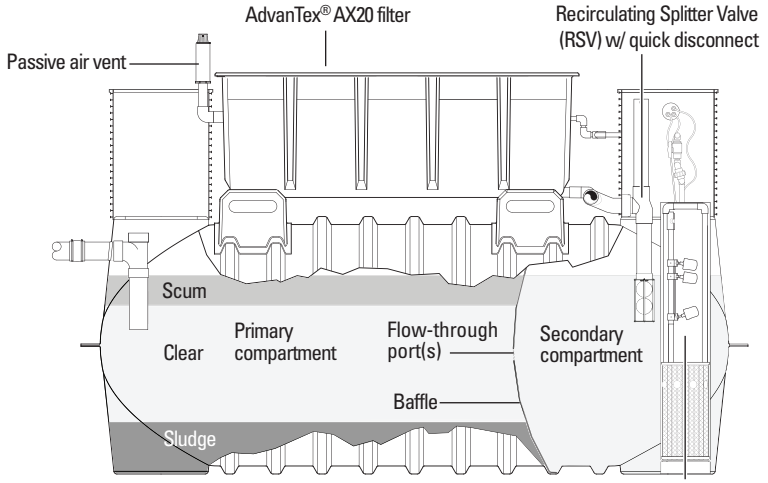
Here's how it works in our standard configuration. (See Figure 1.) Raw sewage enters the two-compartment Processing Tank through its inlet tee. In the first compartment, the raw sewage separates into three distinct zones: a scum layer, a clear layer, and a sludge layer. A flow-through port(s) in the tank's baffle wall allows effluent from the clear layer to flow into the second compartment of the tank. The Biotube® Pump Package in the second compartment pumps filtered effluent to a distribution manifold in the AdvanTex filter. Effluent percolates down through the textile media and is collected in the bottom of the filter pod. The treated effluent flows out of the filter pod through the filtrate return line, which returns the treated effluent to the recirculating splitter valve (RSV). The RSV automatically splits or diverts the flow between the processing tank and the final discharge. The RSV also controls the liquid level within the processing tank. During extended periods of no flow, 100 percent of the treated filtrate effluent is returned to the processing tank. The residential AdvanTex filters have a passive vent system and do not require the use of a fan.

Figure 1. AdvanTex Treatment System

With 1500-gallon (6000-liter), two-compartment processing tank



Top view (lids removed)



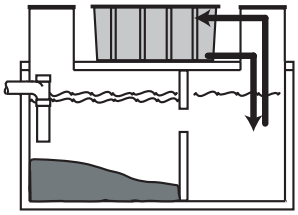
Side cutaway view

System Selection: Models and Configurations

Residential-sized AdvanTex Treatment Systems include the AX20 and the AX20N. These models are identical; however, the AX20N's label carries the NSF mark, per NSF protocol, and is sold in jurisdictions that require NSF-certified product tracking. The AdvanTex Treatment System can be configured in several modes. Mode 1 (shown in Fig. 2a) is the operating configuration used most frequently. In Mode 1, the filtrate recirculates through the second compartment of the processing tank. In Mode 3 (a specialty mode, shown in Fig. 2b), a portion or all of the filtrate may be recirculated through the primary chamber of the tank to enhance nutrient removal. Some of the systems in Mode 1 incorporate two tanks: a primary tank and a recirculation tank. In the primary tank, sludge and scum are separated from liquid effluent, which then flows into a separate recirculation tank, into which the AdvanTex filtrate is recirculated (shown in Fig. 2c). Refer to AdvanTex Treatment System drawings for further details on mode and discharge options.

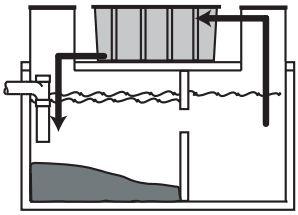
Figure 2. AdvanTex Treatment System Configurations

a) Mode 1



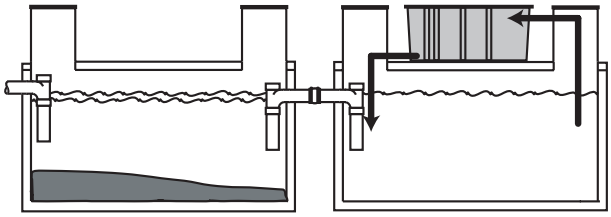
Effluent recirculates into secondary compartment

b) Mode 3



Effluent recirculates into primary compartment for enhanced denitrification

c) Mode 1, Two-Tank System



Effluent recirculates into second tank in a Mode 1 two-tank system

System Requirements: Residential Strength Wastewater

Residential wastewater must meet the criteria in Table 1, below. Consult Orenco or your AdvanTex Dealer for larger system designs.

Table 1. Residential Strength Wastewater (Influent Characteristics)[1]

Characteristic	Average (mg/L)	Weekly Peak (mg/L)	Rarely Exceed (mg/L)
$CBOD_5$	130	200	300
TSS	40	60	150
TKN	65	75	150
G&O	20	25	25

[1] *AdvanTex® Treatment Systems are typically expected to receive residential-strength wastewater from primary septic tanks. Residential-strength wastewater is defined as primary sewage effluent from a septic tank that does not exceed the parameters in this table.*

System Requirements: Processing Tank

Homes with up to four bedrooms require a minimum two-compartment, 1,500-gal (5,700-L) tank with flow-through port(s) equaling a minimum flow-through area of not less than 12 in^2 (77 cm^2) at 60 to 70 percent of the lowest normal liquid level (see the drawing "Typical Liquid Level Positions," NDA-ATXMF). In larger residential systems, the first compartment should be sized at approximately ⅔ to ¾ of the total processing tank volume. Table 2 defines the minimum required tankage for residential AdvanTex applications (unless otherwise approved by both Orenco and the local regulatory body).

All tanks must meet Orenco's minimum structural requirements, be completely watertight, and pass a watertight test including the riser/tank connection. For detailed specifications, see structural and watertightness criteria in Orenco's *General Specifications*, NDA-DG-SPEC-1 and *Acknowledgment of Minimum Tank Requirements*, SLD-TNK-1, as well as the tank specifications checklist in Orenco's *Concrete Tank Questionnaire*, NCL-TNK-TNK-1.

System Selection: Required Tankage and Filter Units

The following tables summarize the required tankage and required number of textile filter units based on occupancy and maximum design flow. Table 2 is for systems using a single processing tank. Table 3 is for systems using separate septic and recirculation tanks.

Requirements assume that residential peak weekly average flows (Q_{pwa}) are typically two times normal average daily flows (Q_a) (in other words, $Q_{pwa} = 2Q_a$), and peak weekly average flows meet typical regulations governing gpd-to-bedroom ratios.

Table 2. Required Tankage and Number of Filter Units: Systems Using Single Processing Tank

Number of Bedrooms[1]	Occupants[2] *maximum*	Processing Tank *minimum size, gal. (L)*	AX Units[4] *model*
4 (or fewer)	8	1,500 (5,700)	1 – AX20[5]
5	10	2,500 (9,500)	2 – AX20[5]
6	12	3,000 (11,400)	2 – AX20[5]

[1] *Use bedrooms as default sizing criteria. (States vary greatly on calculations of gallons per bedroom.) For homes with more than six bedrooms or larger than 5,000 ft^2 (465 m^2), consult Orenco Systems, Inc.*
[2] *Systems with occupancies greater than eight require a design with multiple units based on a minimum of 2.5 ft^2 (0.2 m^2) of surface loading area per capita.*
[3] *Processing tank includes primary (septic) and secondary (recirculation) compartments.*
[4] *The hydraulic application rate for all residential AX units is 29.1 gpd/ft^2 (10.2 L/m^2/day); the nominal hydraulic application rate is 25 gpd/ft^2 (8.8 L/m^2/day).*
[5] *For jurisdictions that require NSF-certified product tracking, the AX20N model should be specified.*

Table 3. Recommended Tankage and Number of Filter Units: Systems Using Separate Septic/Recirc Tanks*

Number of Bedrooms[1]	Occupants[2] *maximum*	Septic Tank *minimum size, gal. (L)*	Recirc Tank[3] *minimum size, gal. (L)*	AX Units[4] *model*
4 (or fewer)	8	1,000 (3,800)	1,000 (3,800 L)	1 – AX20[5]
5	10	1,500 (5,700)	1,000 (3,800 L)	2 – AX20[5]
6	12	2,000 (7,600)	1,000 (3,800 L)	2 – AX20[5]

** See Fig. 2c on previous page.*

[1] *Use bedrooms as default sizing criteria. (States vary greatly on calculations of gal/bedroom.) For homes greater than six bedrooms or greater than 5,000 ft² (465 m²), consult Orenco Systems, Inc.*

[2] *Systems with occupancies greater than eight require a design with multiple units based on a minimum of 2.5 ft² (0.2 m²) of surface loading area per capita.*

[3] *The 1,000-gal minimum is due to float settings/reserve requirements.*

[4] *The hydraulic application rate for all residential AX units is 29.1 gpd/ft² (10.2 L/m²/day); the nominal hydraulic application rate is 25 gpd/ft² (8.8 L/m²/day).*

[5] *For jurisdictions that require NSF-certified product tracking, the AX20N model should be specified.*

Design Loading Rates

Orenco's suggested design loading rates are based on typical per capita flow rates (50 to 60 gal/day/person or 189 to 227 L/day/person) and average strength characteristics expected from residential type installations, as shown in Table 1. Performance is a function of the expected typical loads with periodic weekly highs. Typically, the daily mass loading is based on the expected daily flows and actual strength. Figure 3 shows periodic peak loading capacity at a 95% confidence level. If the loading rate (or mass load) needs to be reduced to meet discharge limits, it's a simple matter of adding additional modular units.

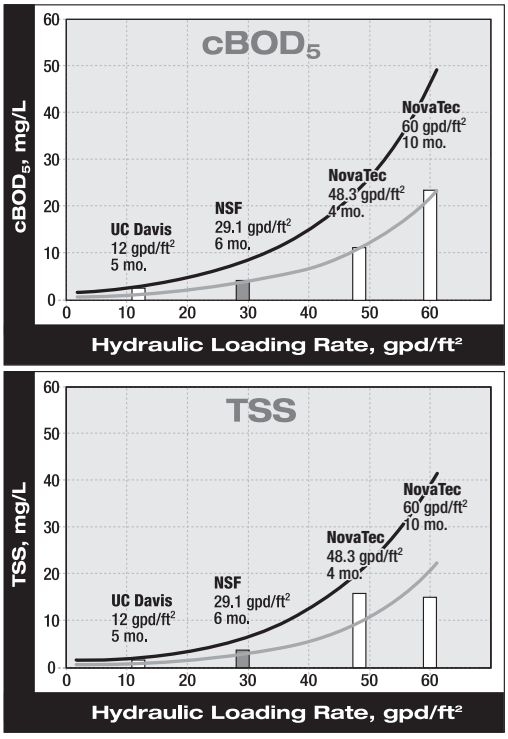
Orenco Systems, Inc.'s AX20N AdvanTex Treatment System is listed as an NSF/ANSI Standard 40 Class I treatment unit, and the listing is for flows up to 1,500 gpd (5,700 L/d) in various configurations.

Typical Effluent Quality

Effluent quality is dependent on a number of factors, including influent characteristics and loading rates. Figure 3 shows third party, NSF/ANSI Standard 40 testing results. The results demonstrate that low-to-moderate loading rates typically produce cBOD and TSS of <5 mg/L, while higher loading rates produce cBOD and TSS in the range of 15-25 mg/L. Field testing of systems in real-world conditions shows similar results, with cBOD and TSS of <10 mg/L. (See *AX Performance Summary*, AHO-ATX-PERF-1.)

Nitrogen reduction in Mode 1 will typically exceed 60 percent, with total nitrogen in the filtrate ranging between approximately 25 and 35 mg/L. In Mode 3, nitrogen reduction can reach 70 percent or better, depending on wastewater strength and other characteristics like grease and oils, pH, and alkalinity concentrations. Nitrification can be inhibited if the buffering capacity (alkalinity) of the wastewater is too low. On a theoretical basis, 7.14 mg/L of alkalinity as $CaCO_3$ is needed to nitrify 1 mg/L of NH_4^+.

Figure 3.
Effluent Quality vs. Hydraulic Loading Rates
ANSI/NSF Standard 40 and Other Third Party Testing Results



Pumping Equipment: Recirculation Pump

The integrated treatment package includes an Orenco 4-inch (100-mm) submersible effluent pump, a Biotube® pump vault, a float assembly with floats, a hose and valve assembly, a splice box, and a control panel.

Residual Head Pressures

A residual pressure of 5 ft (1.5 m) is used to determine the initial timed-dosing settings. (Residual pressure may vary depending on system hydraulics and/or special treatment requirements.) Consulting with Orenco is required when the residual pressure dosing falls outside the typical range of 3 to 6 feet (0.9 to 1.8 meters).

AX20 Residential Design Criteria (cont.)

Recirculation Ratios and Timer Settings

The AdvanTex Treatment System's initial timer settings should be established based on the expected average daily flow and a 4:1 recirculation ratio (filter recirculation ratio). If flows vary significantly from expected flows, timer settings can easily be recalculated and adjusted. See "AX20 Timer Settings Worksheet" in the *Residential AX Installation Manual*, NIM-ATX-AX-1, for more information.

AdvanTex Control Systems

Critical to the success of the AdvanTex Treatment System is the method in which the effluent is loaded onto the AdvanTex textile filter. Over the past three decades, timer-controlled applications have proven to play an essential role in optimizing the performance of both fixed and suspended growth biological systems. A timer-controlled pump in the processing tank periodically doses effluent to a distribution system on top of the AdvanTex filter. Each time the filter is dosed, effluent percolates through the filter media and is treated by naturally occurring microorganisms that populate the filter. During periods of high flow, a timer override float will temporarily modify the timer settings to process the additional flow. Conversely, during periods of low flow, the timer settings can be modified to reduce loading onto the AdvanTex filter. Orenco offers two timed-dose control panels with the AdvanTex Treatment System.

Orenco's VeriComm® (VCOM) remote telemetry control panels and Web-based monitoring system are incorporated into all AdvanTex Treatment System standard equipment packages. VeriComm gives wastewater system operators and maintenance organizations the ability to monitor and control each individual system's performance remotely. There are several additional operational benefits associated with telemetry-based controls, including Advanced Control Logic — functions that activate in the event of component malfunction to diagnose the system using pre-established trend data and, if necessary, modify the operation of the system until it can be serviced. VeriComm also provides additional alert and alarm functions to notify the operator/designer in the event that trend data indicate potential problem conditions (e.g., high flows).

In some markets, Orenco offers our Most Versatile Panel (MVP) series panels as an alterative to our VCOM panels. MVP control panels include an easy-to-use programmable logic unit that incorporates many timing and logic functions. The units have built-in screens that show time and date, elapsed pump run times, pump cycle counts, high-level alarm and override cycle counts, and low-level alarm counts, as well as power fault information and operating hours. In addition, there are separate screens that show the status of the panel's digital inputs and outputs. These features give operators and maintenance providers the ability to monitor individual systems on site. Alarm events activate the panel's audible and visual alarms.

Surge Volume

For most residential applications, the recommended surge volume is approximately 150 to 250 gallons (570 to 950 L). The actual surge volume used should be approximately 50 to 100 percent of the actual average daily flow. The surge volume is the volume between the normal low liquid level and the override timer float. The normal low liquid level is the level at which 100 percent of the filtrate returns to the tank. For most residential installations, the low liquid level will be approximately 5 to 6 inches (130 to 150 mm) to below the top of the RSV cage. Refer to the *AdvanTex Installation Guide*, NIM-ATX-AX-1, for details.

Reserve Volume

A typical AdvanTex Treatment System on a four-bedroom home has a 1,500-gallon processing tank. There are about 400 gallons (1,500 L) of emergency storage between the normal operating liquid level and the inside top of the tank. Assuming that the average home produces about 250 gpd (950 L/d), the emergency storage volume in an AdvanTex system is sufficient for 1.5 days.

Power outage: During a power outage, water usage will be significantly reduced because water heaters, dishwashers, and laundry equipment will not be used. Under these conditions, it is realistic to estimate that water usage will be reduced by 50 percent to around 125 gpd (475 L/d). Therefore, in a power outage, the emergency storage capacity available in an AdvanTex system increases to approximately three days' worth. Because power outages typically last no more than one day, the emergency storage of an AdvanTex system is adequate.

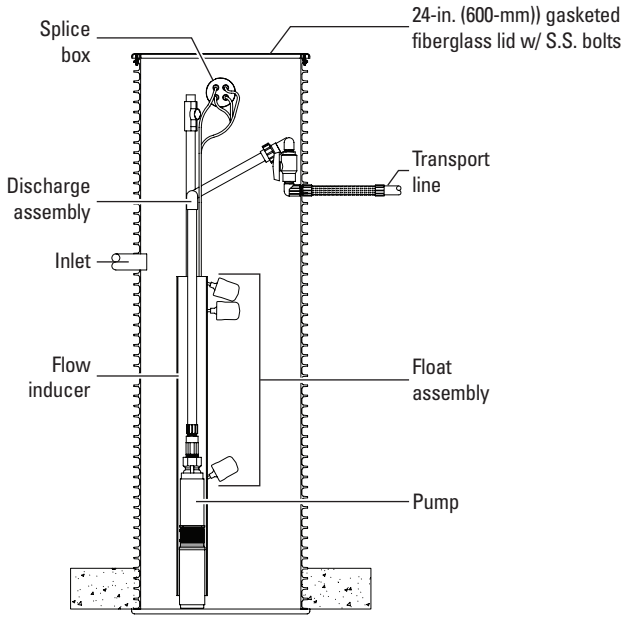
Mechanical component failure: Failure of a pump or electrical component may cause the system to stop operating, requiring some amount of emergency storage volume. The VeriComm Monitoring System immediately notifies the Authorized Service Provider of the alarm condition and indicates the cause of the alarm. This allows the Service Provider to bring the right replacement component. In most cases, no more than one day (250 gallons or 950 L) would be needed for the Service Provider to respond and get the system running again.

Discharge Equipment

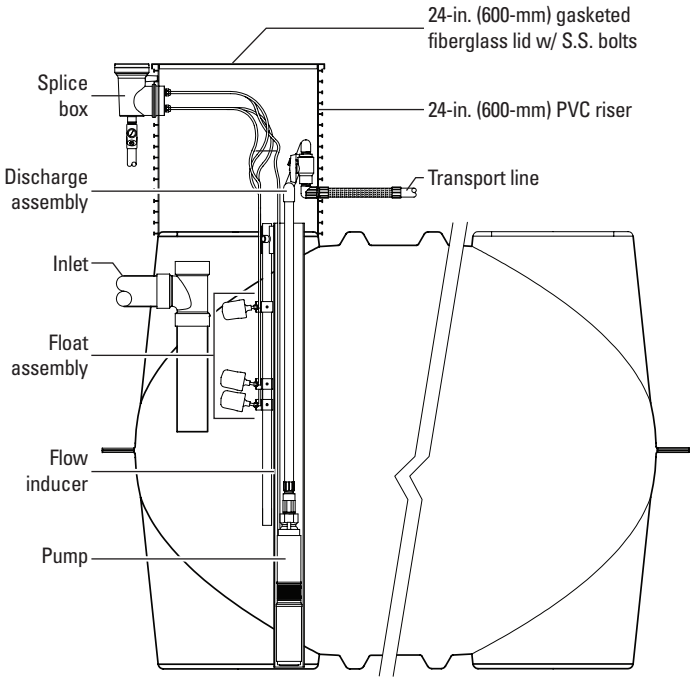
There are two discharge options: gravity and pump. When discharging by pump, an Orenco pump basin can be used. (See Figure 4a.) Alternatively, some designs may call for pumping out of a tank. (See Figure 4b.)

All tanks must meet Orenco's minimum structural requirements, be completely watertight, and pass a watertight test including the riser/tank connection. For detailed specifications, see structural and watertightness criteria in Orenco's *General Specifications*, NDA-DG-SPEC-1 and *Acknowledgment of Minimum Tank Requirements*, SLD-TNK-1, as well as the tank specifications checklist in Orenco's *Concrete Tank Questionnaire*, NCL-TNK-TNK-1.

Figure 4. Pump Discharge Options



a) Pump basin discharge



b) Pump tank discharge

Cold Weather Considerations

AX20 units are available with 1-in. (25-mm) insulation attached to the bottom of the lid. Installing insulation around the sides of the filter pods themselves is optional and is done on site as needed. Other cold weather considerations include standard practices used with most onsite pump systems, such as allowing all lines to drain, insulating processing tank lids, and backfilling risers with pea gravel if frost-heave is a concern. The filter vent may need to be extended above the highest level of the snowpack during winter months. Consult Orenco if supplementary options need to be considered.

AdvanTex® Design Criteria

Orenco Systems® Incorporated
800-348-9843

For Single-Family Home Applications — AX20-RT Treatment Unit

System Description and Treatment Process

The AdvanTex® Treatment System is a multiple-pass, packed-bed aerobic wastewater treatment system specifically designed and engineered for long-term processing of residential strength wastewater. The treatment media is an engineered textile, which has an extremely high void capacity, moisture-holding capacity, and surface area per unit volume. Consequently, AdvanTex Treatment Systems are capable of processing residential strength wastewater to better than "secondary standards."

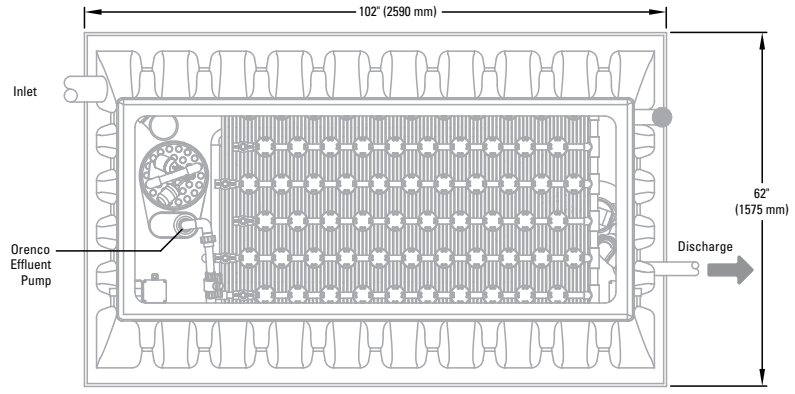
The AX20-RT uses the same recirculating textile filter technology as Orenco's other textile filter, the AX20, but combines the textile filter media, recirculation tank and discharge tank into a single, shallowly buried unit.

Here's how it works: raw sewage enters the septic tank through its inlet tee. In the septic tank, the raw sewage separates into three distinct zones — a scum layer, a sludge layer, and a clear layer. Effluent from the clear layer passes through a Biotube® effluent filter and is discharged by gravity to the recirculation chamber of the AX20-RT unit, which contains a Biotube Pump Package.

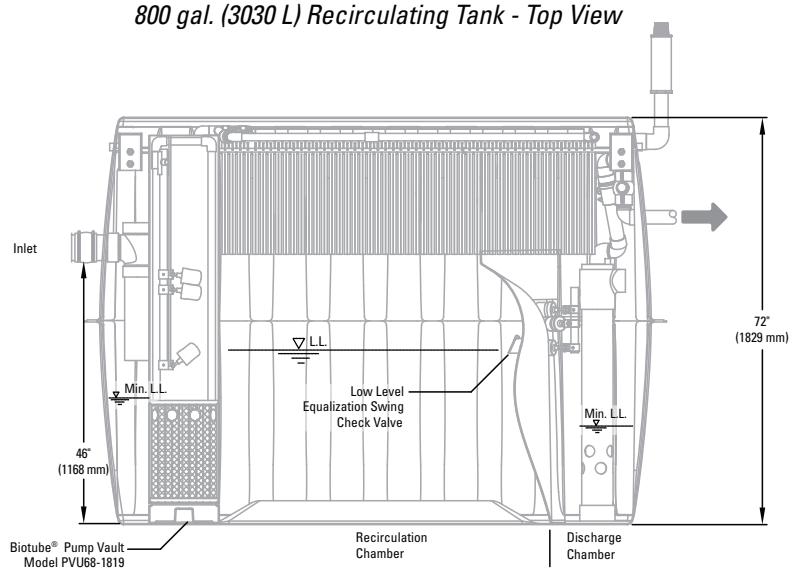
The recirculation pump is timer controlled to ensure that small, intermittent doses (micro-doses) of effluent are applied to the textile sheets throughout the day. This ensures an aerobic, unsaturated environment for optimal treatment to occur. A manifold rests on top of the textile sheets, which distributes the effluent evenly over the textile sheets. The effluent then percolates down through the textile sheets and is distributed between the recirculation and discharge chambers by means of the AX20-RT baffle.

The textile material is suspended from the top of the treatment unit, with most of the media (normally 70%) positioned over the recirculation chamber. The remainder of the media is positioned over a separate discharge chamber that is separated from the recirculation chamber by a recirculation-splitter baffle, and from which filtrate is discharged.

Figure 1. AdvanTex AX20-RT Treatment Unit



800 gal. (3030 L) Recirculating Tank - Top View



800 gal. (3030 L) Recirculating Tank - Side View

The recirculation-splitter baffle is fitted with a swing-check valve for low-level equalization. Under low daily flow conditions, the swing-check valve allows 100% of the final filtrate to be returned to the recirculation chamber for continued recirculation. The swing-check valve is similar to a check valve in that it allows preferential flow in one direction only, in this case, from the discharge chamber to the recirculation chamber. The swing-check valve closes when the liquid head on the recirculation side is equal to or greater than the liquid head on the discharge side. When the liquid head on the discharge side is higher, the pressure differential pushes the swing-check valve open for filtrate to pass back to the recirculation side of the baffle, thus providing for continued recirculation during periods of low or no inflow. Flow from the recirculation chamber can pass to the discharge chamber only through the treatment media.

AX20-RT Residential Design Criteria (cont.)

System Requirements: Residential Strength Wastewater

Residential wastewater must meet the criteria below in Table 1. Consult Orenco or your AdvanTex Dealer for larger system designs.

Table 1. Residential Strength Wastewater (Influent Characteristics)[1]

Characteristic	Average (mg/L)	Weekly Peak (mg/L)	Rarely Exceed (mg/L)
$CBOD_5$	130	200	300
TSS	40	60	150
TKN	65	75	150
G&O	20	25	25

[1] *Maximum allowable wastewater strength pumped to an AdvanTex Treatment System is "Residential Strength Wastewater." Residential strength wastewater is defined as primary sewage effluent from a septic tank that does not exceed the above parameters.*

System Requirements: Septic Tank

The septic tank preceding the AX20-RT unit requires a minimum usable volume of 1000 gal. (3800 L), and must incorporate an effluent filter at its outlet. The effluent filter should have a minimum surface area of 5-ft^2 (0.46 m^2). Any of the following Orenco effluent filters can be used: FT0822-14B, FTW0444-36V, or FTS0444-36V. The septic tank should include an at-grade access, with a securable and removable lid to allow access to the effluent filter and inlet tee of the tank. The septic tank will be required to pass a watertight test before final acceptance.

A minimum slope of ⅛ in. per foot (10 mm per meter or 1%) from the outlet of the septic tank to the inlet of AX20-RT shall be required for all septic tanks that will flow via gravity to the AX20-RT unit. The top of the AX20-RT should be 2 in. above final grade. The invert of the inlet is 26 in. (660 mm) below the top of the unit and 46 in. (1168 mm) above the bottom of the unit. For existing tanks that are buried too deep to provide sufficient fall to the AX20-RT, a pumping system has to be installed in the septic tank to move the filtered effluent to the AX20-RT unit. (Contact Orenco for design assistance.)

All tanks must meet Orenco's minimum structural requirements, be completely watertight, and pass a watertight test including the riser/tank connection. For detailed specifications, see structural and watertightness criteria in Orenco's *General Specifications*, NDA-DG-SPEC-1 and *Acknowledgment of Minimum Tank Requirements — AX20-RT*, SLD-TNK-2, and tank specifications checklist in Orenco's *Concrete Tank Questionnaire*, NCL-TNK-TNK-1.

Water softener backwash from a salt-type water softener must not be plumbed into the septic tank, or AX20-RT unit, as this will void the system's warranty. See the Orenco white paper, *Water Softeners and Wastewater Treatment Systems*, AWP-SOFT-1, for more information.

Design Loading Rates

Orenco's suggested design loading rates are based upon typical per capita flow rates (50-60 gpd/person or 189-227 L/day/person) and average strength characteristics as shown in Table 1. Performance is a function of the expected typical loads with periodic weekly highs. Typically, the daily mass loading is based on the expected daily flows and actual strength. Figure 2 shows periodic peak loading capacity at a 95% confidence level.

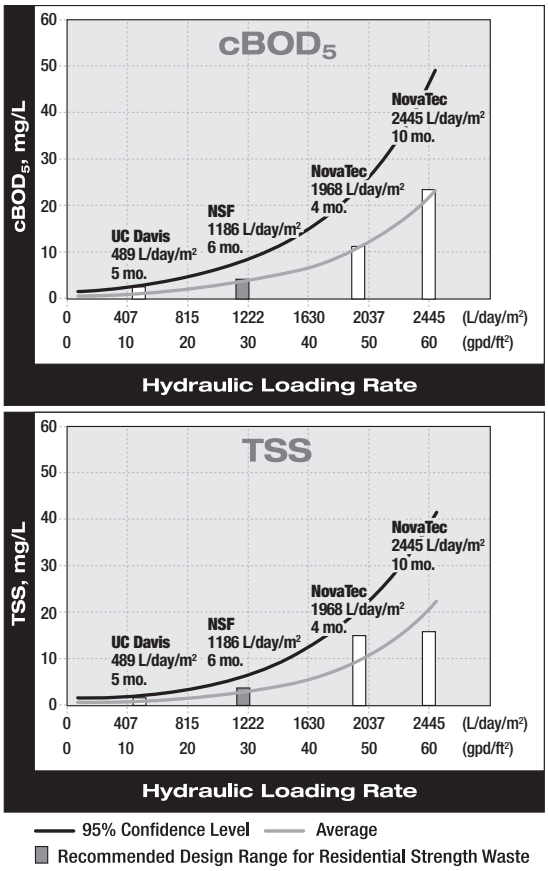
Orenco's AX20-RT is listed as an NSF/ANSI Standard 40 Class I treatment unit, and is suitable for residences with up to 4 bedrooms. For applications with more than 4 bedrooms, multiple pods of Orenco's AdvanTex AX20 product line are necessary.

Typical Effluent Quality

Effluent quality is dependent on a number of factors, including influent characteristics and loading rates. Figure 2 shows third party, NSF/ANSI Standard 40 testing results. The results demonstrate that low-to-moderate loading rates typically produce cBOD and TSS of < 5 mg/L, while higher loading rates produce cBOD and TSS in the range of 15-25 mg/L. Field testing of systems in real-world conditions shows similar results, with cBOD and TSS of < 10 mg/L. (See *AX Performance Summary*, AHO-ATX-PERF-1.)

Nitrogen reduction in Mode 1 will typically exceed 60 percent, with total nitrogen in the filtrate ranging between 25-35 mg/L. In Mode 3, nitrogen reduction can reach 70 percent or better, depending on wastewater strength and other characteristics like grease and oils, pH, and alkalinity concentrations. Nitrification can be inhibited if the buffering capacity (alkalinity) of the wastewater is too low. On a theoretical basis, 7.14 mg/L of alkalinity as $CaCO_3$ is needed to nitrify 1 mg/L of NH_4^+.

Figure 2.
Effluent Quality vs. Hydraulic Loading Rates
Third Party, NSA/ANSI Standard 40 Testing Results



Pumping Equipment: Recirc Pump

The integrated treatment package includes an Orenco Biotube® pump package.

Residual Head Pressures

A 5-foot (1.5-m) residual pressure is used to determine the initial timed-dosing settings. Consult Orenco if the residual pressure falls outside the typical 3-6 ft (0.9-1.8 m) range.

Recirculation Ratios and Timer Settings

The AX20-RT initial timer settings should be established based upon expected average daily flows and a recirculation ration of 4:1 (filter recirculation ratio). If flows vary significantly from expected flows, timer settings should be adjusted accordingly. Contact Orenco for more information.

AdvanTex Control System

Critical to the success of the AdvanTex Treatment System is the method in which the effluent is loaded onto the textile sheets. Over the past three decades, timer-controlled applications have played an essential role in optimizing the performance of both fixed and suspended-growth biological systems. A timer controlled pump in the treatment tank periodically doses effluent to the distribution manifold over the textile sheets. The effluent then percolates through the textile media and is treated by naturally occurring microorganisms that populate the filter. During periods of high flow, a timer override float will temporarily modify the timer settings to process the additional flow. Conversely, during periods of low flow, the timer settings can be modified to reduce loading onto the filter.

Surge Volume/ Emergency Reserve Volume

For residential applications, the AX20-RT has 120 gallons (454 liters) of surge volume. The surge volume in the AX20-RT is the volume between the low liquid level and the override timer float. There is an additional 80 gallons (303 liters) of surge volume above the override activation point.

The AX20-RT System has designed-in emergency storage to account for power outages and mechanical malfunctions. In the US, power outages occur infrequently and typically last from a few hours to 1-2 days. Down time associated with mechanical malfunctions is limited due the robustness of the mechanical components of the AX20-RT. Replacement components are readily available and the system can usually be returned to normal operation within hours or a day at most.

The total emergency storage capacity of the AX20-RT, measured from the recirculating high water alarm up to the inside top of the unit, is approximately 500 gallons (1890 liters). On units configured to gravity out, wastewater will discharge as designed during a power outage or mechanical component failure and no back-ups will occur.

A minimum 1000-gallon (3785-liter) septic tank is required to precede the AX20-RT unit. As water rises above the invert of inlet in the AX20-RT unit, the water will back up into the septic tank. Consequently, the liquid capacity available in the septic tank can also provide storage during emergencies. The available capacity will vary depending upon the tank design but typically 1000-gallon tanks hold about 200 gallons (760 liters) between the invert of outlet and the inside top of the tank.

Most 3- or 4-bedroom homes produce about 250 gallons (950 liters) of wastewater each day (3-4 occupants at 50-60 gallons or 190-230 liters per occupant per day) as a conservative estimate. Between the septic tank and the AX20-RT unit there is approximately 700 gallons (2650 liters) of emergency storage capacity, which equates to approximately 3 days' emergency reserve.

Power outage — During a power outage, water usage is significantly reduced because water heaters, dishwashers, and laundry equipment aren't used. Under these conditions, it is realistic to estimate that water usage will be reduced by 50 percent to around 100 gpd (473 L/d) and the emergency storage capacity available in the system will increase to approximately 7 days. Since power outages typically last less than 2 days, the emergency storage capacity of the system is more than adequate.

AX20-RT Residential Design Criteria (cont.)

Mechanical malfunction — Failure of a pump or electrical component may cause the system to stop operating, requiring some amount of emergency storage volume. If the system is equipped with a VeriComm Monitoring System, the Service Provider is immediately notified of the alarm condition and the potential cause of the alarm. This allows the Service Provider to respond very quickly with the correct replacement components necessary to fix the problem. In most cases, no more than one day (250 gallons or 950 liters) would be needed for the Service Provider to respond and get the system running again. Therefore, the emergency storage capacity available in the AX20RT System during a mechanical malfunction, approximately 3 days' worth, is quite adequate.

Discharge Equipment

There are two discharge options: gravity or pump.

Gravity Discharge to Final Dispersal — The invert of the outlet at the wall penetration is located 40½ in. (1013 mm) below the top of the unit and 31½ in. (800 mm) above the bottom of the unit. The invert of the outlet inside of the unit is 37 in. (940 mm) below the top of the unit and 35 in. (889) above the bottom of the unit.

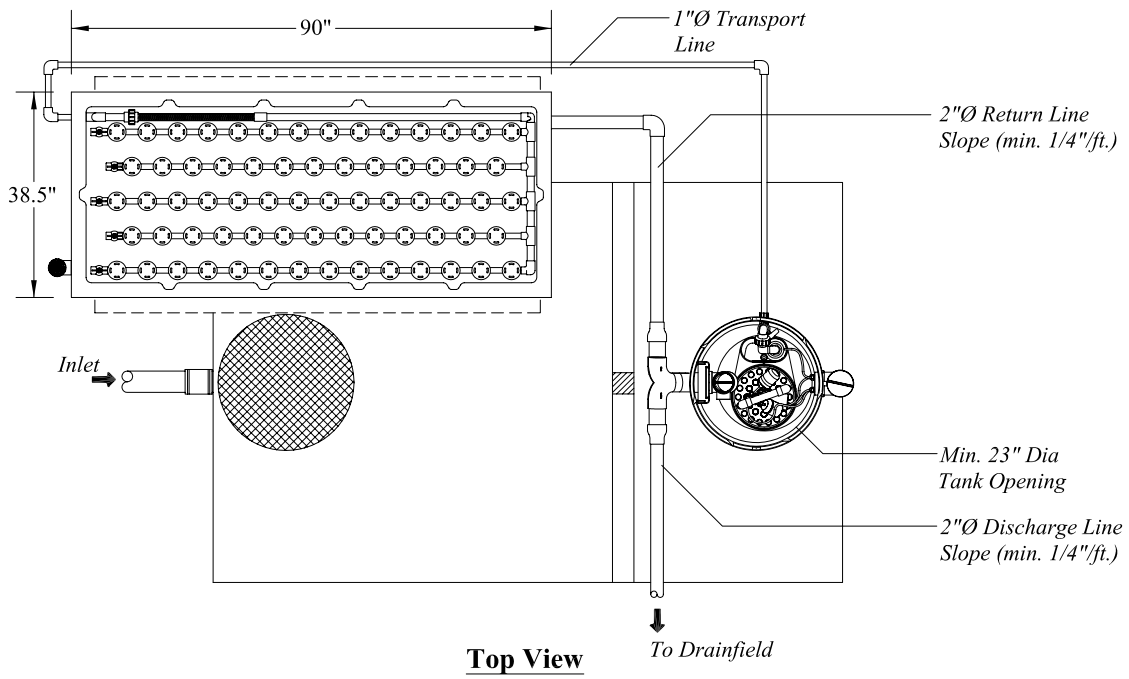
Pump Discharge to Final Dispersal – For sites where gravity discharge is not an option, a flow inducer (for housing a 4-inch submersible effluent pump) is incorporated into the discharge chamber of the AX20-RT unit.

For areas that require disinfection before dispersal, a UV unit can be installed in a pump basin that houses both a UV unit and discharge pump.

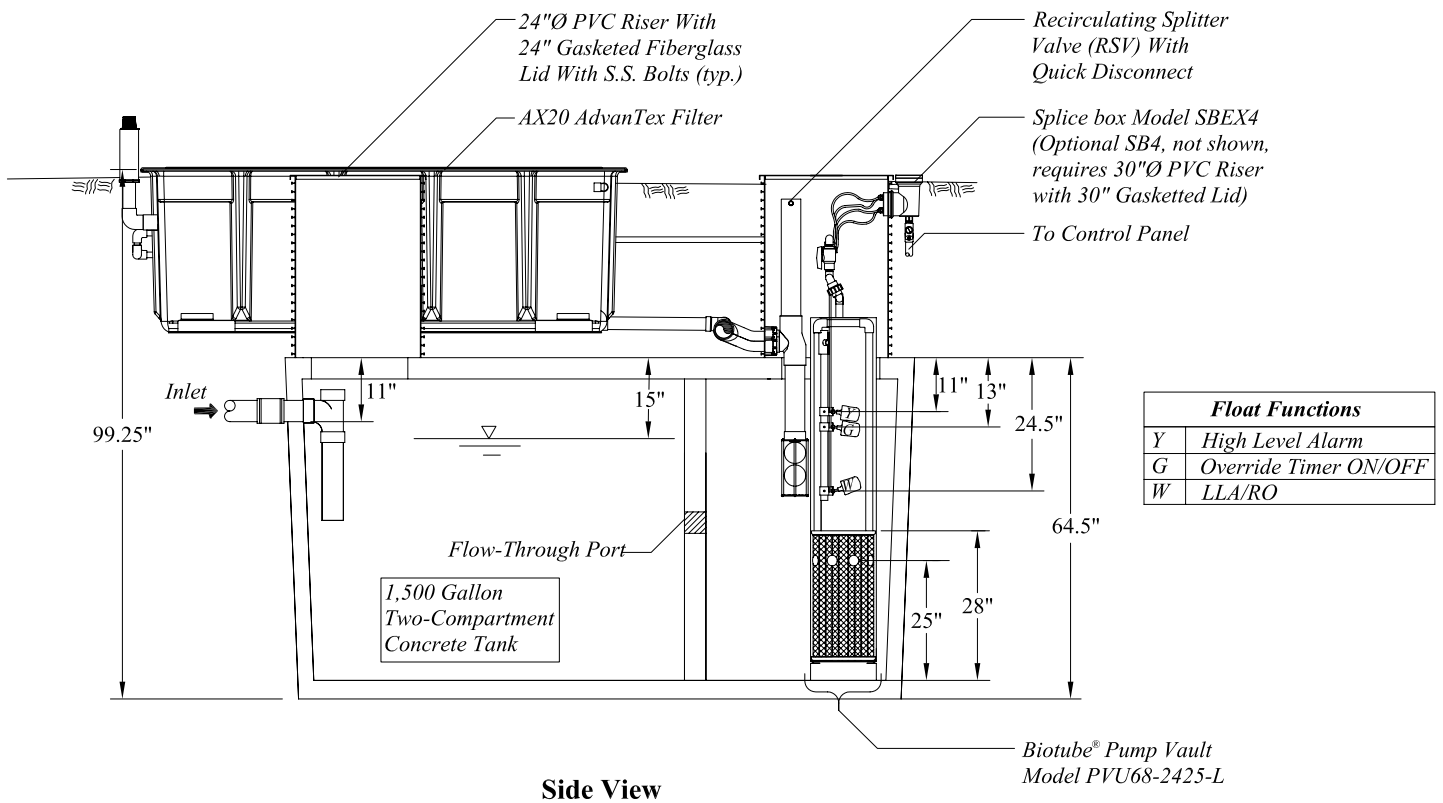
Cold Weather Considerations

The AX20-RT unit can be ordered with 1-in. (25-mm) of insulation attached to the bottom of the lid. Installing insulation around the sides of the filter pod is optional and is done on-site as needed. Other cold weather considerations include allowing all lines to drain between doses, backfilling the risers with pea gravel if frost heave is a concern, and extending the passive vent filter above the highest level of snow pack during winter months to ensure adequate airflow. Consult Orenco if supplementary options need to be considered.

AdvanTex® AX20 Mode 1A w/Concrete Tank

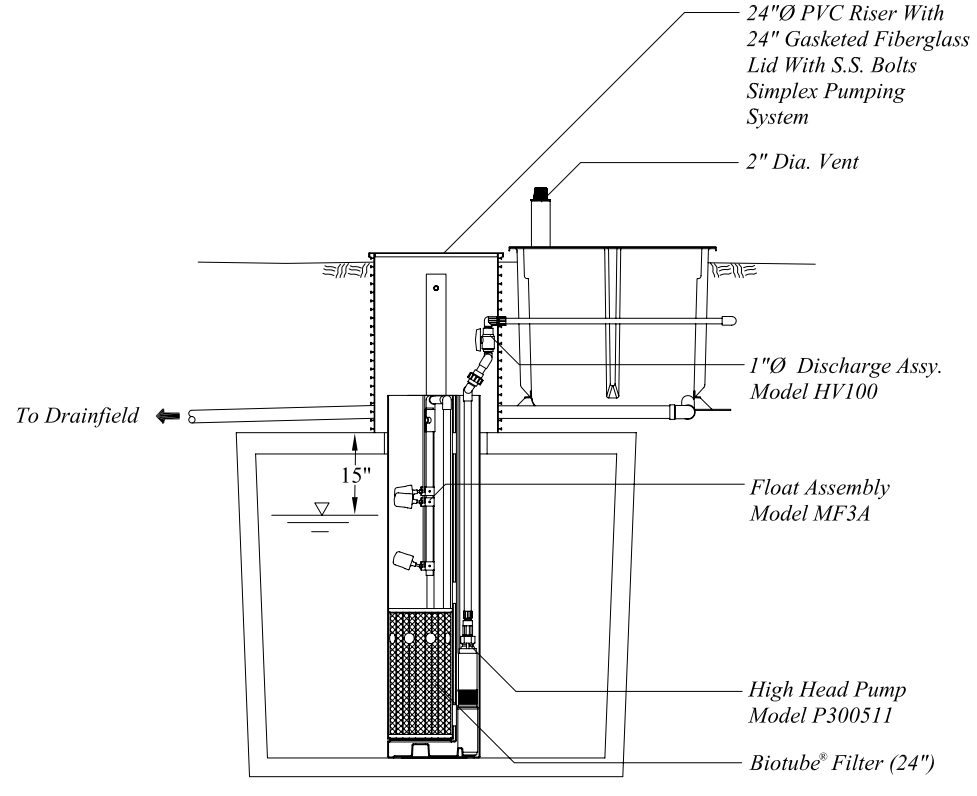


Top View
Scale: 1" = 3'-0"



Float Functions	
Y	*High Level Alarm*
G	*Override Timer ON/OFF*
W	*LLA/RO*

Side View
Scale: 1" = 3'-0"



End View
Scale: 1" = 3'-0"

Design Notes

Expected Flows
- Q_{Peak} = 500 gpd

Up To 4 Bedrooms

Expected Influent Quality
Grease & Oil: 20 mg/L
BOD: 150 mg/L
TSS: 40 mg/L
TKN: 65 mg/L

Typical Effluent Quality
BOD: < 10 mg/L
TSS: < 10 mg/L
TN: < 25 mg/L

Orenco Systems® Incorporated

Title: AdvanTex® - AX20 Mode 1A

Drawing No. NDW-ATX-STD-1

Scale: 1" = 3'-0"

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Date: 02/14/2006

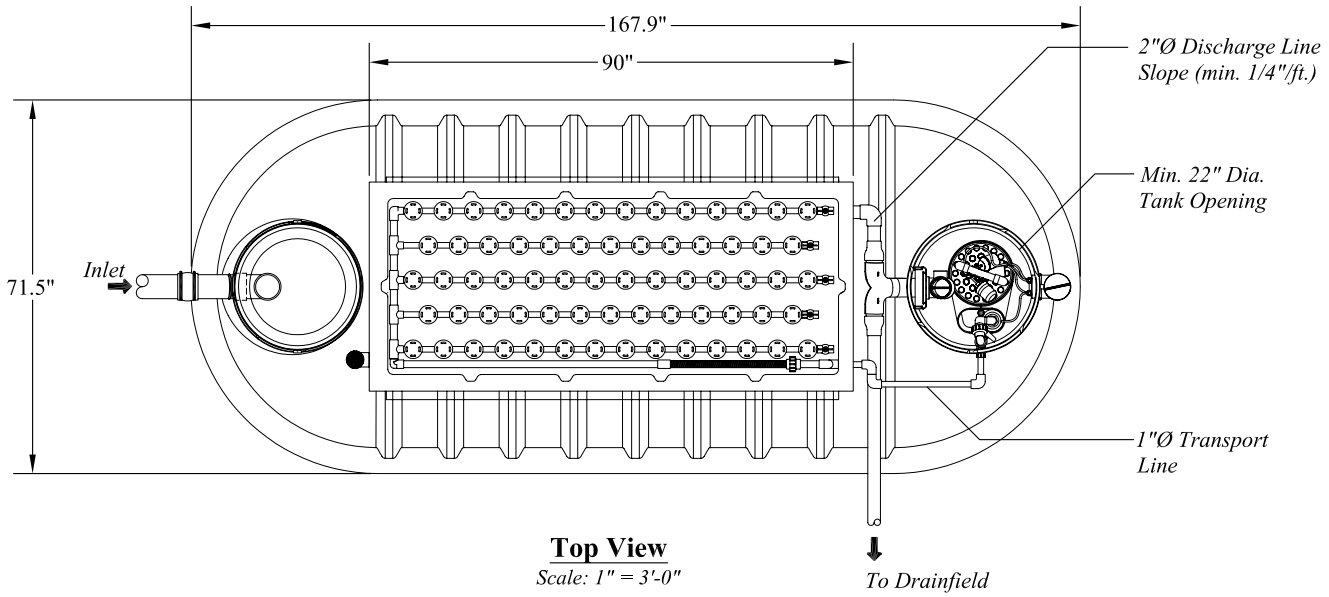
Designed By: ENGINEERING

Approved By: TERRY BOUNDS PE

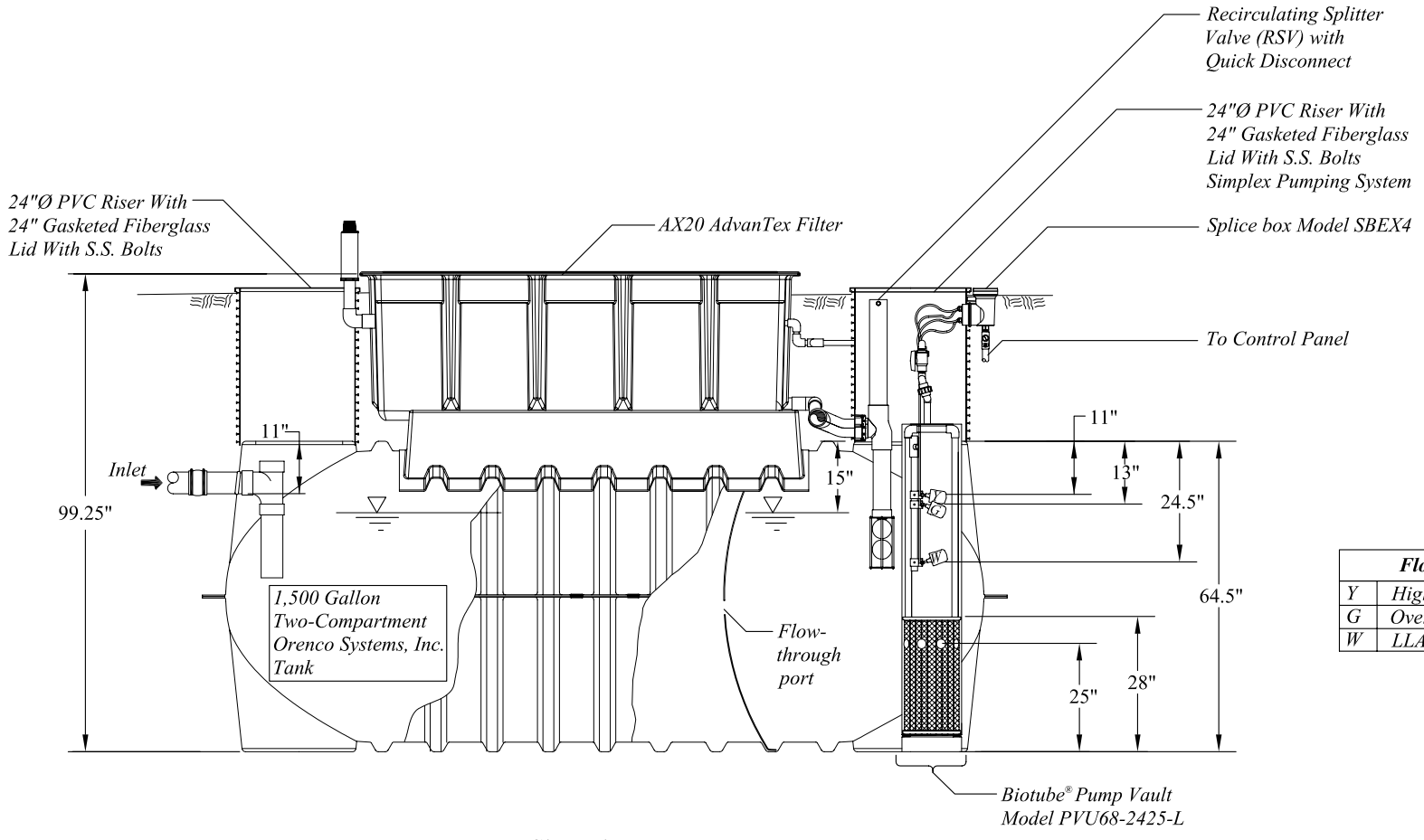
Revision: 2.0

Date Approved: 02/14/2006

AdvanTex® AX20 Mode 1A w/Fiberglass Tank

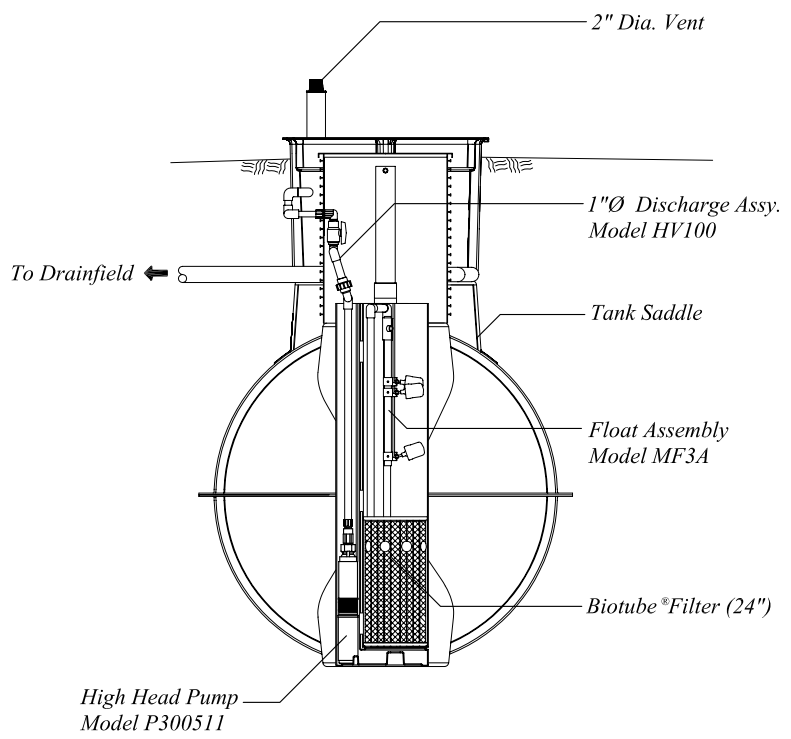


Top View
Scale: 1" = 3'-0"



Side View
Scale: 1" = 3'-0"

Float Functions	
Y	*High Level Alarm*
G	*Override Timer ON/OFF*
W	*LLA/RO*



End View
Scale: 1" = 3'-0"

Design Notes

Expected Flows
- Q_{Peak} = 500 gpd

Up To 4 Bedrooms

Expected Influent Quality
Grease & Oil: 20 mg/L
BOD: 150 mg/L
TSS: 40 mg/L
TKN: 65 mg/L

Typical Effluent Quality
BOD: < 10 mg/L
TSS: < 10 mg/L
TN: < 25 mg/L

Orenco Systems® Incorporated

Title: AdvanTex® AX20 Mode 1A

Drawing No. NDW-ATX-STD-3

Scale: 1" = 3'-0"

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Revision: 2.0

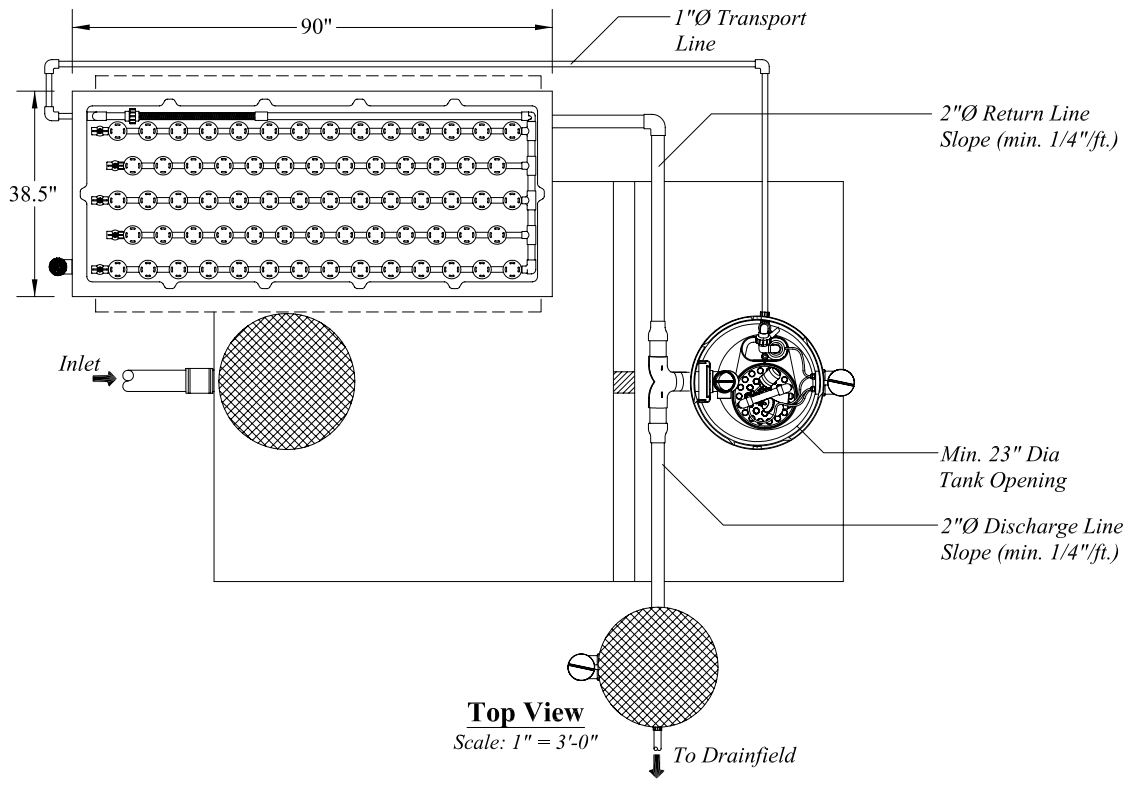
Designed By: ENGINEERING

Approved By: TERRY BOUNDS PE

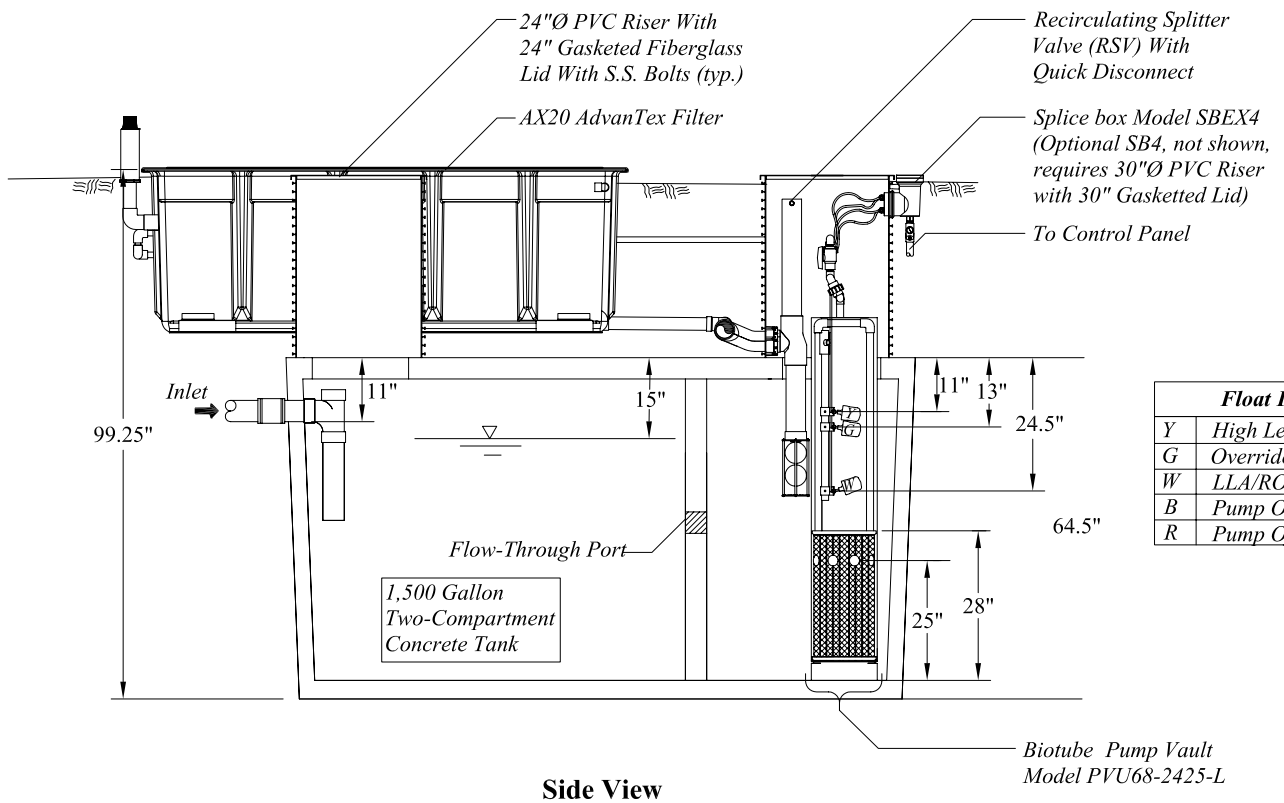
Date: 02/14/2006

Date Approved: 02/14/2006

AdvanTex® AX20 Mode 1B w/Concrete Tank

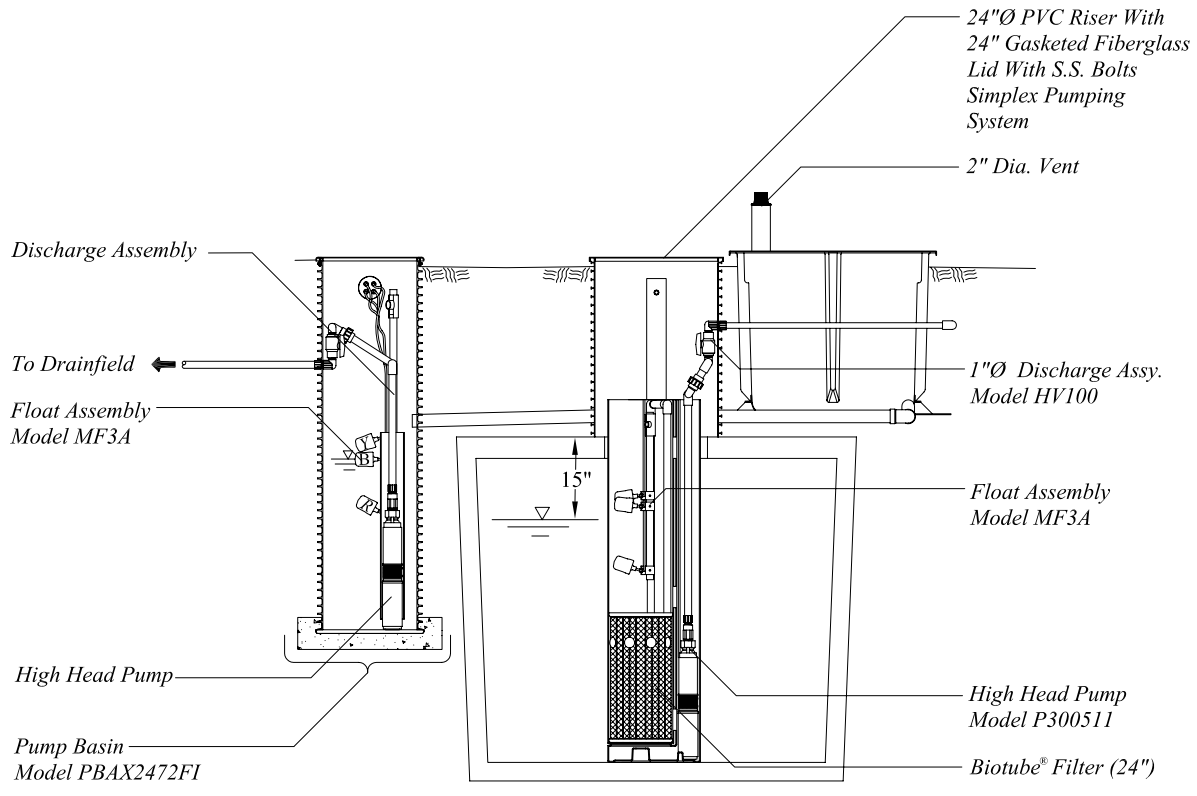


Top View
Scale: 1" = 3'-0"



Side View
Scale: 1" = 3'-0"

Float Functions	
Y	High Level Alarm
G	Override Timer ON/OFF
W	LLA/RO
B	Pump On
R	Pump Off



End View
Scale: 1" = 3'-0"

Design Notes

Expected Flows
- Q_{Peak} = 500 gpd

Up To 4 Bedrooms

Expected Influent Quality
Grease & Oil: 20 mg/L
BOD: 150 mg/L
TSS: 40 mg/L
TKN: 65 mg/L

Typical Effluent Quality
BOD: < 10 mg/L
TSS: < 10 mg/L
TN: < 25 mg/L

Orenco Systems® Incorporated

Title: AdvanTex® - AX20 Mode 1B

Drawing No. NDW-ATX-STD-2

Scale: 1" = 3'-0"

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Date: 02/14/2006

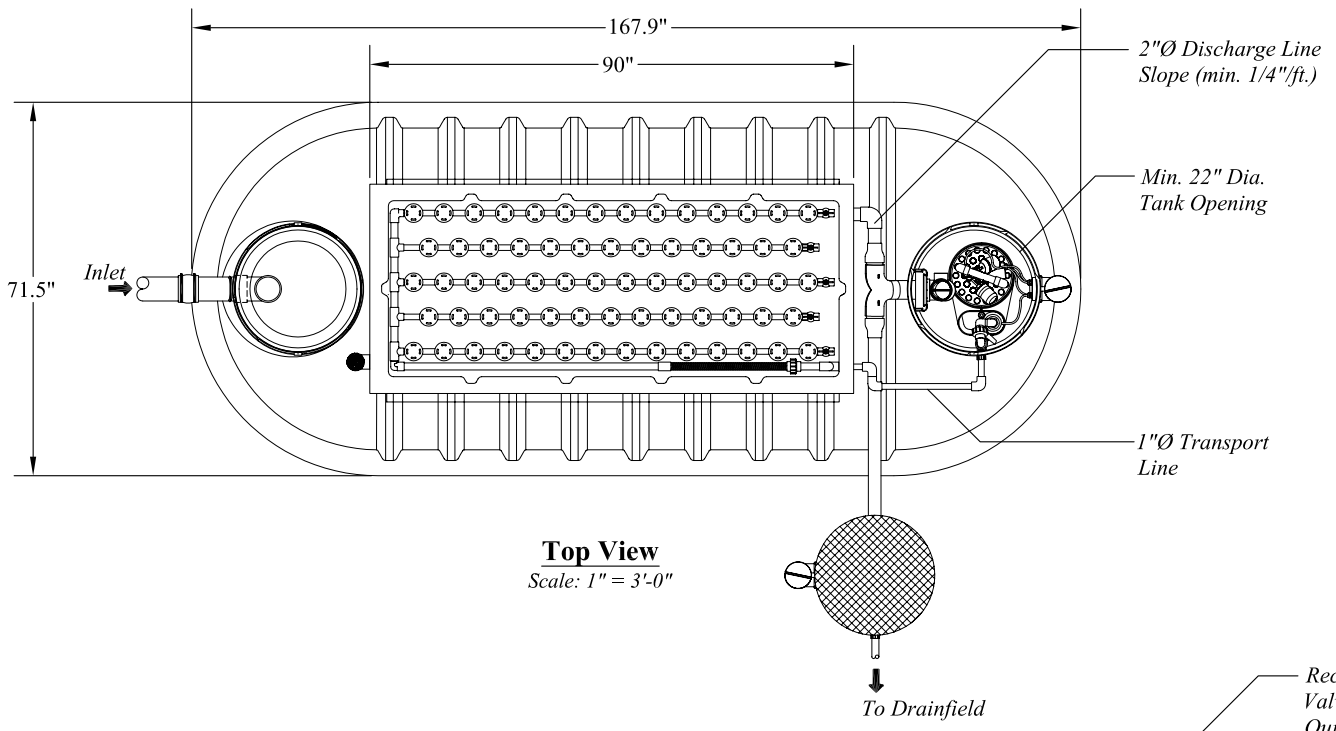
Designed By: ENGINEERING

Approved By: TERRY BOUNDS PE

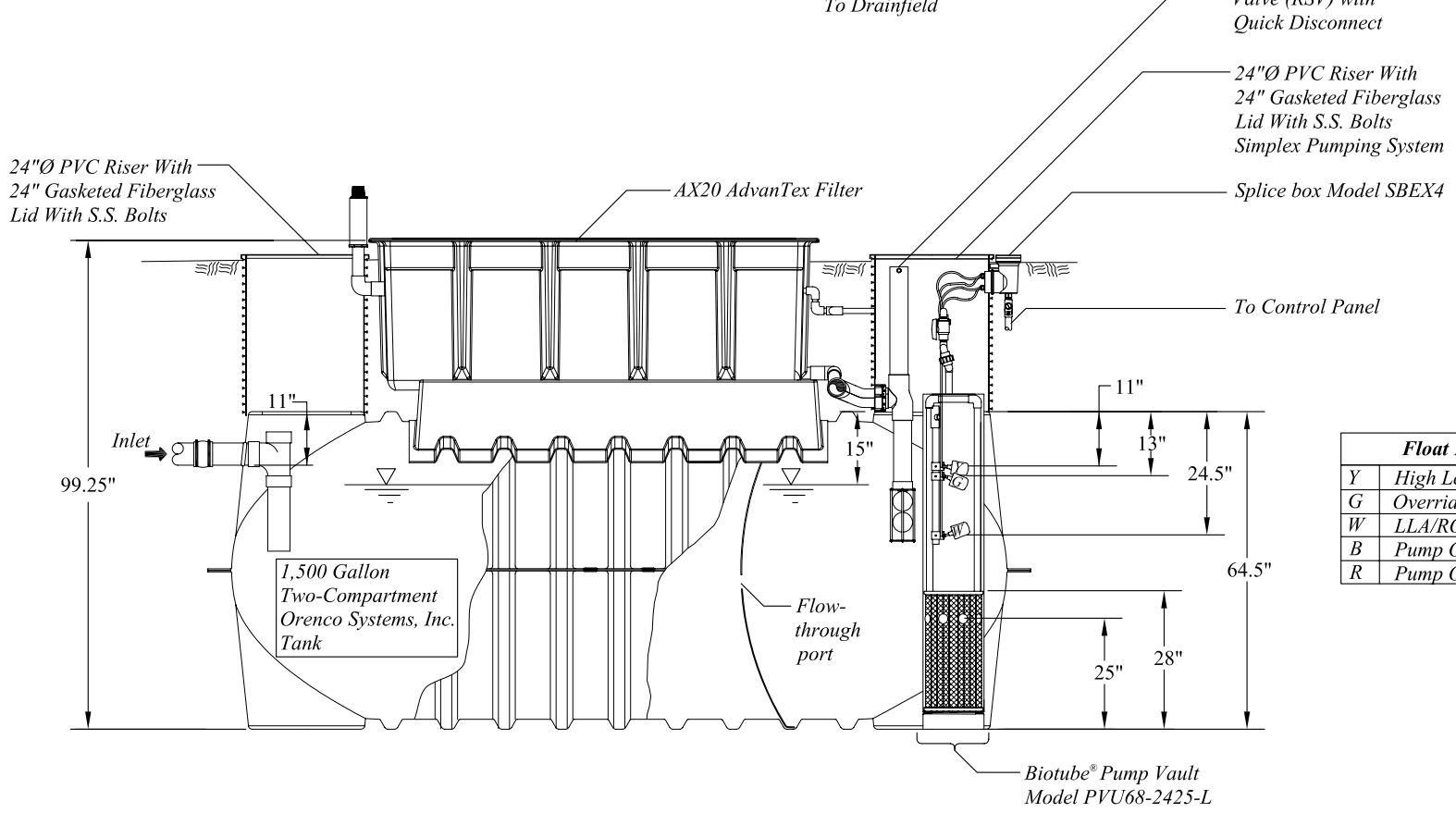
Revision: 2.0

Date Approved: 02/14/2006

AdvanTex® AX20 Mode 1B w/Fiberglass Tank

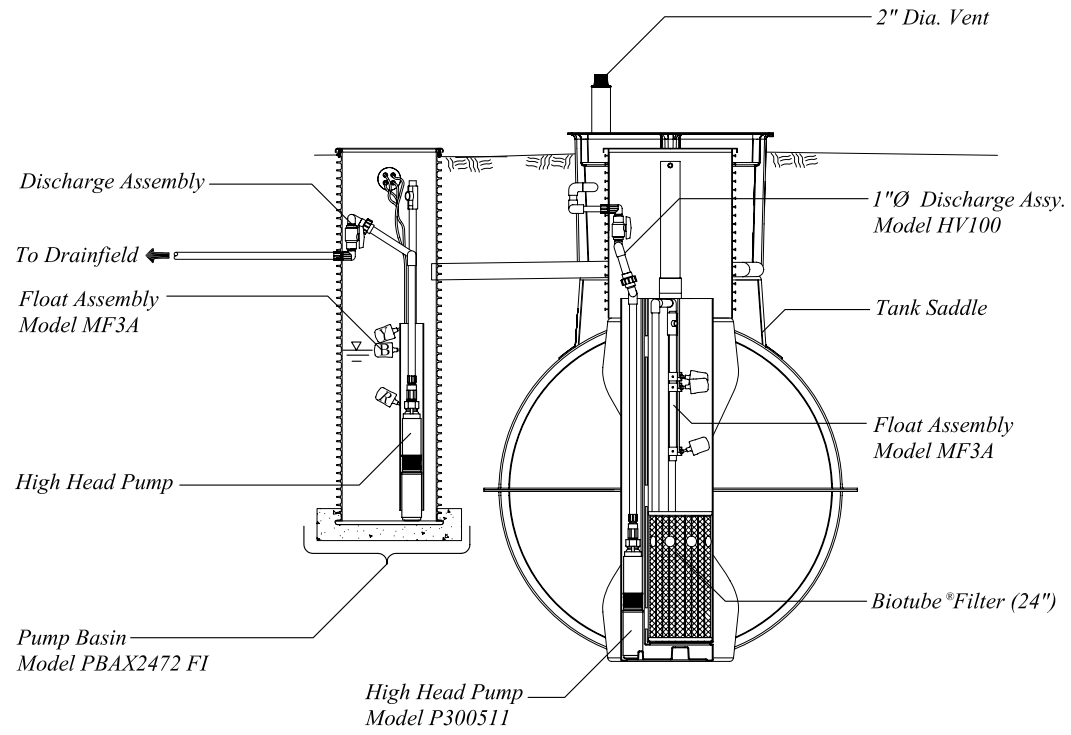


Top View
Scale: 1" = 3'-0"



Side View
Scale: 1" = 3'-0"

Float Functions	
Y	*High Level Alarm*
G	*Override Timer ON/OFF*
W	*LLA/RO*
B	*Pump On*
R	*Pump Off*



End View
Scale: 1" = 3'-0"

Design Notes

Expected Flows
- Q_{Peak} = 500 gpd

Up To 4 Bedrooms

Expected Influent Quality
Grease & Oil: 20 mg/L
BOD: 150 mg/L
TSS: 40 mg/L
TKN: 65 mg/L

Typical Effluent Quality
BOD: < 10 mg/L
TSS: < 10 mg/L
TN: < 25 mg/L

Orenco Systems® Incorporated

Title: AdvanTex® AX20 Mode 1B

Drawing No. NDW-ATX-STD-4

Scale: 1" = 3'-0"

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Date: 02/15/2006

Designed By: ENGINEERING

Approved By: TERRY BOUNDS PE

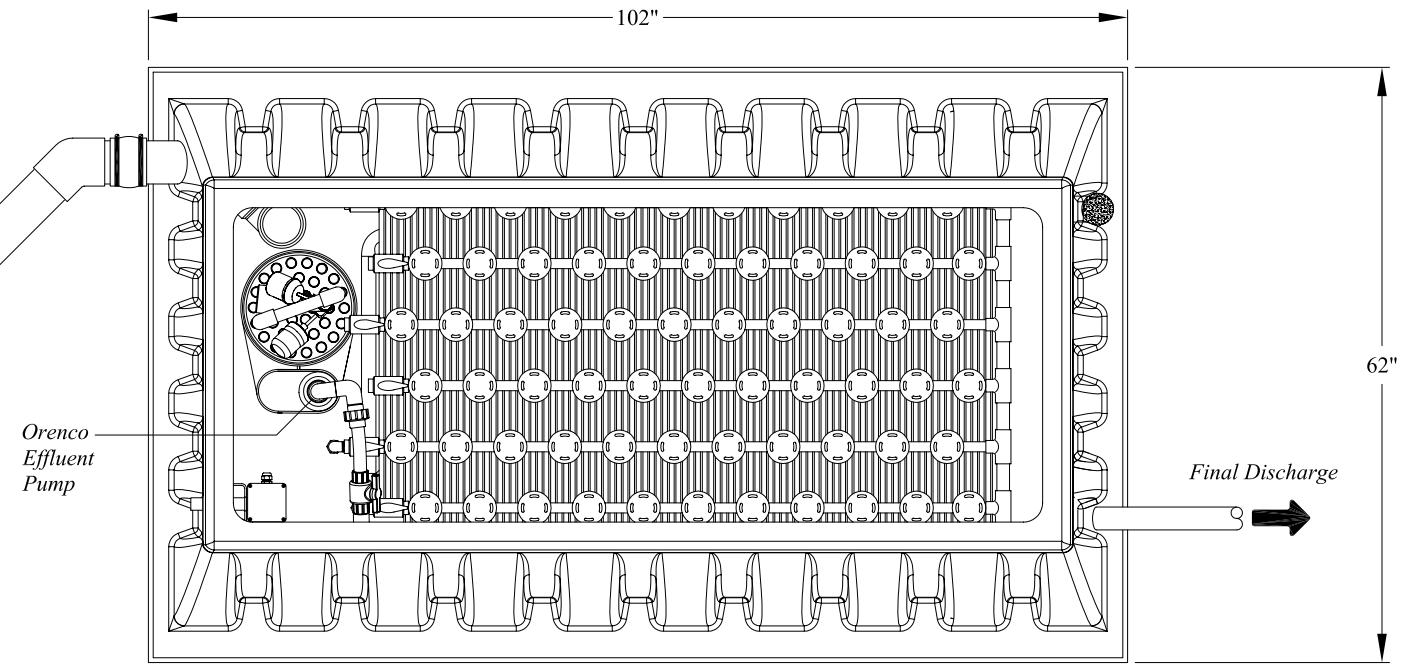
Revision: 2.0

Date Approved: 02/15/2006

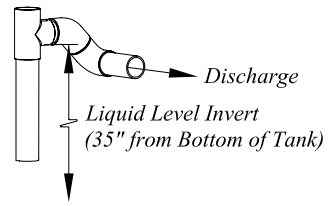
Gravity Discharge, 2-Comp. Recirculating Tank

Filter Tank Dry Weight: 860 lbs

1000 gal. Primary Tank - Top View

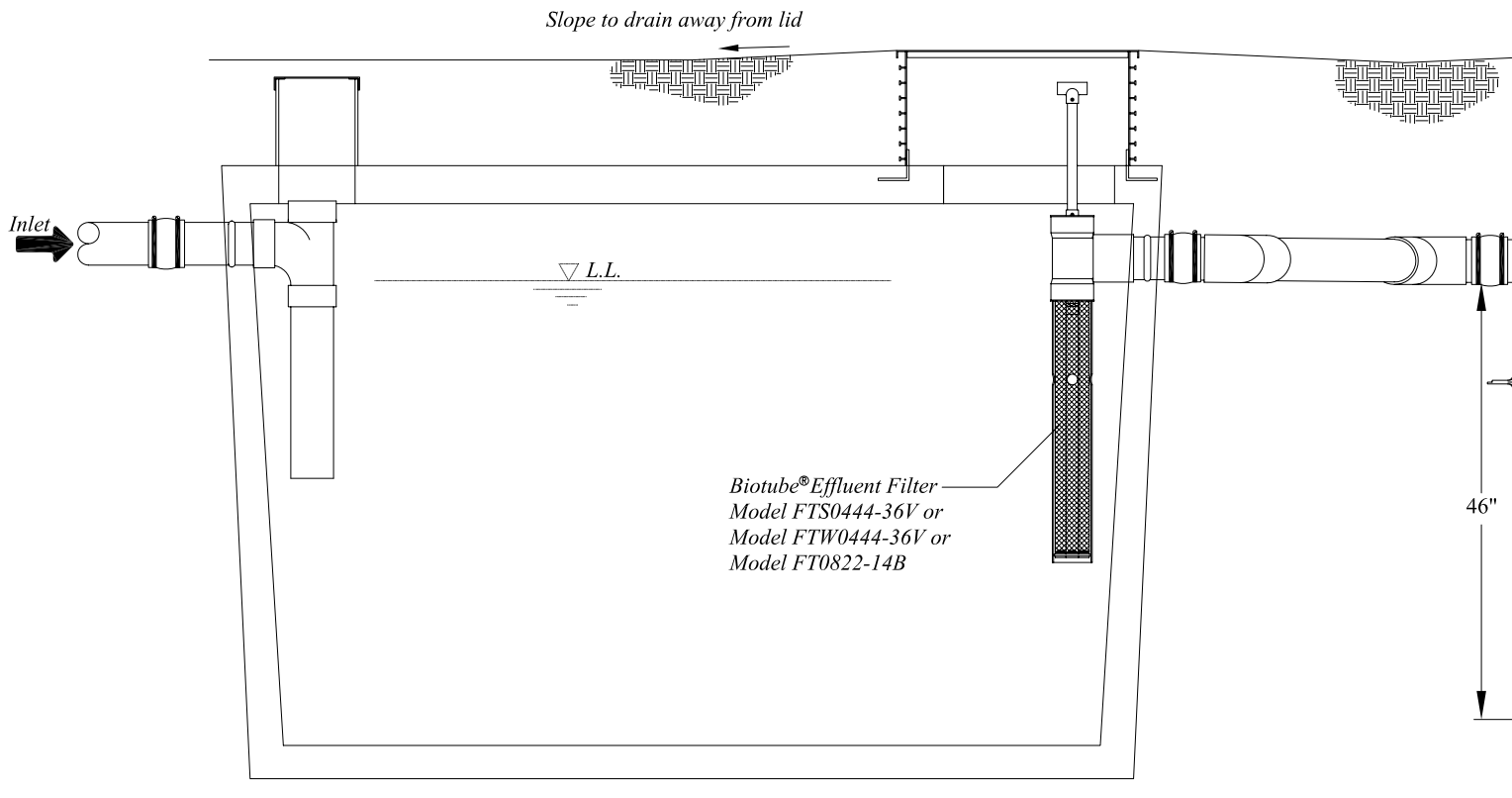


800 gal. Recirculating Tank - Top View

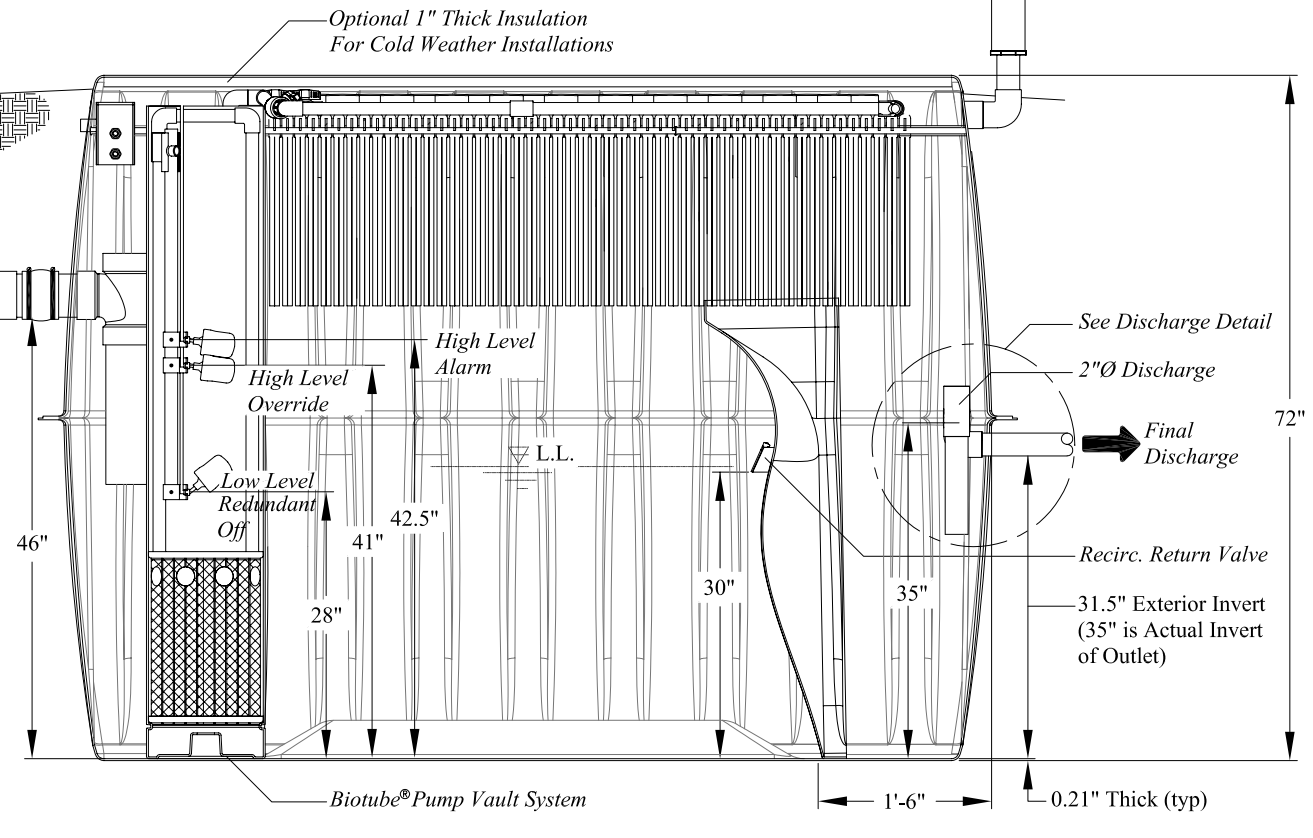


Discharge Detail

Not To Scale



1000 gal. Primary Tank - Side View



800 gal. Recirculating Tank - Side View

Orenco Systems® Incorporated

Title: AX20RT-Mode 1A

Drawing No. NDW-ATX-RT-STD-01

Scale: 1" = 20"

Date: 6/09/2010

Drawn By: CHRIS JORDAN

Drawing: 1 OF 3

Revision: A-03

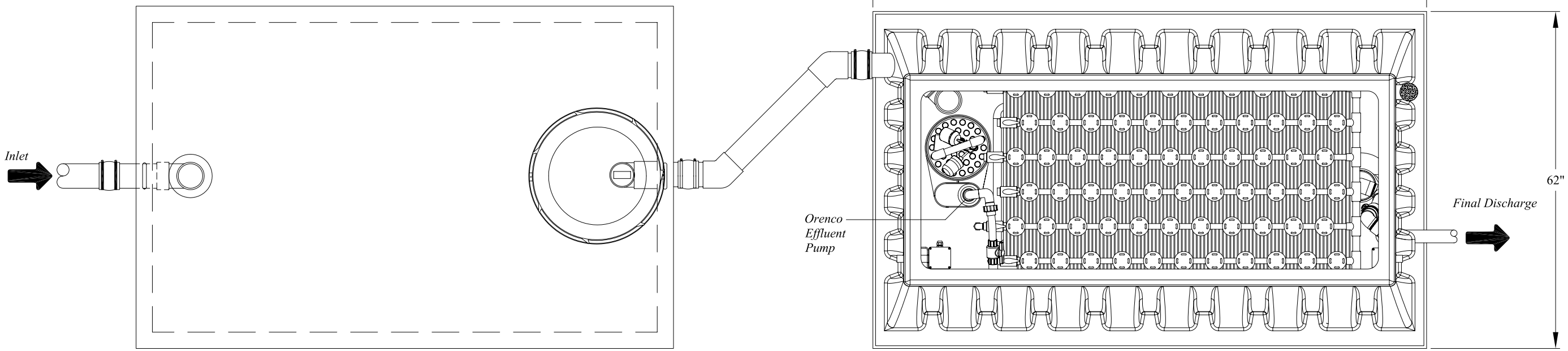
Designed By: ENGINEERING

Approved By:

Date Approved:

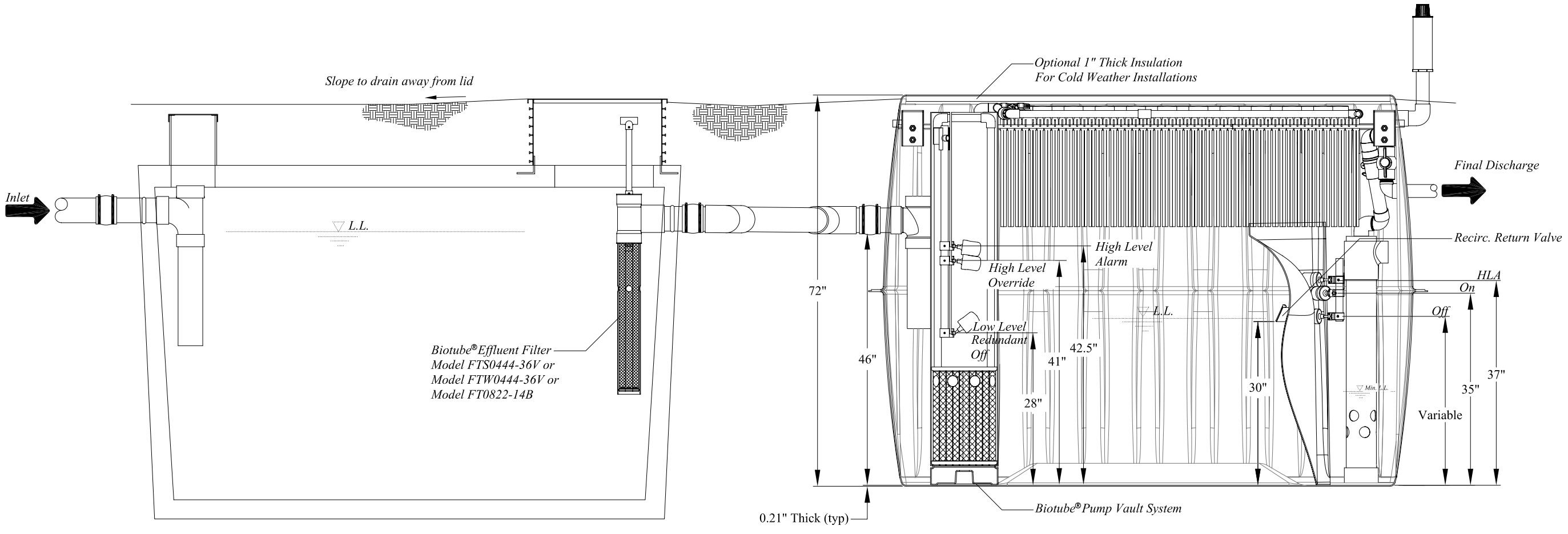
Pump Discharge, 2-Comp. Recirculating Tank

Filter Tank Dry Weight: 900 lbs



1000 gal. Primary Tank - Top View

800 gal. Recirculating Tank - Top View



1000 gal. Primary Tank - Side View

800 gal. Recirculating Tank - Side View

Orenco Systems® Incorporated

Title: AX20RT - Mode 1B

Drawing No. NDW-ATX-RT-STD-03

Scale: 1" = 20"

Drawn By: CHRIS JORDAN

Drawing: 3 OF 3

Date: 6/09/2010

Designed By: ENGINEERING

Approved By:

Revision: A-03

Date Approved:

Homeowner Worksheet

Orenco Systems®
Incorporated
800-348-9843

Choosing a Wastewater Treatment System

If you're like most homeowners, you're probably unfamiliar with wastewater treatment systems. And that's not surprising. After all, how often do you ever choose one? Maybe once or twice in a lifetime?

From our headquarters near Roseburg, Oregon, we at Orenco Systems have been educating homeowners, wholesalers, installers, operators, regulators, builders, and real estate agents about wastewater treatment systems for the past 25 years. Here are some questions that every homeowner should ask before choosing a system:

- ***NOISE***
  How noisy is the system? Will it keep me awake at night?
- ***ODOR***
  Does the system have a reputation for being smelly? For foaming up and out of the tank?
- ***ELECTRICITY COST***
  How much will the electricity cost me, each and every month, to run the system?
- ***VISUAL IMPACT***
  What am I going to see in my back yard? How much of my yard will the system take up?
- ***RELIABLE PERFORMANCE***
  Will my system work properly and reliably, even when I'm using it a lot? (For example, when I'm doing laundry or entertaining guests.) How about when I'm not using it enough? (For example, when I go on vacation.)
- ***ALARMS***
  If something goes wrong with the system, do I have to stop what I'm doing? Do I have to handle the alarm? What if I'm not home? Can the system automatically notify a Service Provider? Can the Service Provider handle alarms from his or her computer, without making a costly service call?
- ***ALERTS***
  If I'm using more water than my system is designed to handle (for example, if a toilet valve gets stuck), does my system have some kind of a quiet "early-warning signal"?
- ***MAINTENANCE COSTS AND SERVICEABILITY***
  How many service calls does the system typically require in any given year? How often will the system have to be pumped and how much will that cost? Are the system and its components easy for service providers to reach and clean?
- ***EQUIPMENT REPLACEMENT COSTS***
  Are there components in the system (such as pumps, controls, blowers, or aerators) that will have to be replaced within a few years? What are the repair/replacement costs for those components? How long is the warranty for those replacement components?
- ***WARRANTIES***
  How long is the warranty for the treatment system?

(Worksheet on back)

	Orenco AdvanTex® Filter	Orenco Sand Filter	Activated Sludge (aka "Aerobics" or "ATU")	Fill In:
Noise	Occasional clicking from control panel, so panel should be mounted on a post, not a wall.	Occasional clicking from control panel, so panel should be mounted on a post, not a wall.	Noisy external blower or aerator runs 24 hours/day.	
Odor	Not typical	Not typical	Some is typical	
Electricity Cost	$1.00/mo*	$0.25/mo*	$15.00-40.00/mo*	
Visual Impact	System footprint typically measures 75 ft^2. Control panel on post plus four ground-level lids.	System footprint typically measures 440 ft^2. Control panel on post, three ground-level lids, and 4-15 valve box lids.	System footprint similar to AdvanTex. Control panel on post, 3-4 ground-level lids, and above-ground housing for blower or aerator.	
Reliable Performance	System can handle all normal household uses.	System can typically handle all normal household uses, depending on tankage and control panel.	System not found to work reliably with heavy use or low use. During heavy use, wastewater runs quickly through the system because of its "gravity-in, gravity-out" setup. After low use, restart can shock the system. In both cases, untreated or partially treated waste can flow to the drainfield.	
Alarms	Alarm transmitted automatically to contracted Service Provider, who can often adjust system remotely, via a phone connection. 24-48 hour reserve capacity in tank (depending on usage), so system still usable.	Homeowner must turn alarm off and find/call a Service Provider. 24-48 hour reserve capacity in tank (depending on usage), so system still usable.	Homeowner must turn off alarm and call Service Provider.	
Alerts	Monitoring system quietly alerts service provider via e-mail of excessive water use, preventing future problems.	No quiet alert for excessive water use, but audible alarms available.	Not available.	
Maintenance Costs and Serviceability	Two service calls in first year. Annual service call thereafter.† 8-12 year pumping interval (assumes 3-4 occupants, 1,000-gal primary chamber). At-grade installation of treatment unit for ease of servicing all components and media.	Annual service call. 8-12 year pumping interval (assumes 3-4 occupants, 1,000-gal tank). At-grade installation of treatment unit. Easy servicing of components but not media.	Two service calls per year. 6-month servicing interval for all air filters. 3-6 month pumping interval.‡ Below-grade installation of treatment unit makes servicing of all components difficult.	
Equipment Replacement Costs	Expected pump life and controls life of 20+ years. No blowers or aerators to replace.	Expected pump life and controls life of 20+ years. No blowers or aerators to replace.	6-month life cycle on air filters. Expected 3-5 year life cycle on blower or aerator.§	
Warranties	Varies by region, but is at least 3 years on complete system.	1-year warranty on treatment system components, 3-year warranty on control panel.	Varies; typically 2-year warranty on parts.	
Value-Added Features	In addition to Treatment System, package includes: Control Panel: ☐ Alarm only ☐ Alarm, timers ☑ Alarm, timers, and telemetry (to communicate with Service Provider) Tankage: ☐ Yes (_____ gal) ☐ No Discharge Basin: ☐ Yes ☐ No	In addition to Treatment System, package includes: Control Panel: ☐ Alarm only ☑ Alarm, timers ☐ Alarm, timers, and telemetry (to communicate with Service Provider) Tankage: ☐ Yes (_____ gal) ☐ No Discharge Basin: ☐ Yes ☐ No	In addition to Treatment System, package includes: Control Panel: ☐ Alarm only ☐ Alarm, timers ☐ Alarm, timers, and telemetry (to communicate with Service Provider) Tankage: ☐ Yes (_____ gal) ☐ No Discharge Basin: ☐ Yes ☐ No	In addition to Treatment System, package includes: Control Panel: ☐ Alarm only ☐ Alarm, timers ☐ Alarm, timers, and telemetry (to communicate with Service Provider) Tankage: ☐ Yes (_____ gal) ☐ No Discharge Basin: ☐ Yes ☐ No

* Based on national averages for $/kWh ($0.08) and occupants (3). Assumes single pump or blower/aerator. Assumes pump run time of 20 min/day for AdvanTex, 4.5 minutes per day for sand filter, and blower/aerator run time of 24 hours/day for ATUs.

† For non-NSF models. NSF models have two service calls per year in first two years.

‡ Based on U.S. EPA's Onsite Wastwater Treatment Manual, TFS-2 (chart)

§ ibid, p. 4-55, "4.8.6. Costs"

Installation Manual

AdvanTex® AX20 Treatment Systems

Residential Applications

An illustrated guide to installing an Orenco AdvanTex® AX20 Treatment System in a residential application.

Installation DVD Available! Call Your Dealer.

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Installation Manual: *Residential AdvanTex® AX20 Systems*

Installation Manual: *Residential AdvanTex® AX20 Systems*

Before You Begin

As the installer of an onsite wastewater treatment system, you play a crucial role. Dealers, regulators, homeowners, manufacturers, neighbors, service providers ... we all rely on your expertise and good work. At Orenco, we've worked hard to make your installation as easy and "hassle-free" as possible.

Property owners, neighbors, regulators, Dealers, manufacturers, and service providers all depend on your careful installation.

We're very proud of this wastewater treatment system. Like all our products, the AdvanTex® AX20 Treatment System has gone through extensive research, development, and field-testing. Then each component is built to written specifications and subjected to quality review before shipping. In addition, our AX20N models meet the requirements of NSF-ANSI Standard 40 for Class I Systems. If this system or any of its components possesses flaws that would inhibit its proper functioning, please contact your authorized AdvanTex Dealer. The Dealer can also provide repair and replacement instructions and replacement components. If there is no authorized AdvanTex Dealer in your area, call Orenco Systems, Inc. at 800-348-9843 or 541-459-4449.

This manual covers installation of all residential models of our AdvanTex AX20 Treatment Systems, including Mode 1 and Mode 3 configurations. If you're unsure which mode you are installing, check the design drawing. It's important that you read through this entire manual before doing anything. And make sure you have the correct equipment, materials, tools, and training to perform this installation.

Additionally, each Orenco control panel comes with panel-specific information and instructions on wiring, timer settings, and operating instructions. Please read all other documents included with the control panel, as well.

Also, be sure to get a copy of our AX20 Install Video from your AdvanTex Dealer. Watching the video will help you understand the installation process. However, please note that the manual contains more detail and is updated more often than the video, and *you must perform the installation according to the current manual to keep the warranty in force*.

Once you become familiar with the installation process, you should be able to install an AdvanTex AX20 Treatment System in half a day, not counting the time to install the tank and dispersal system.

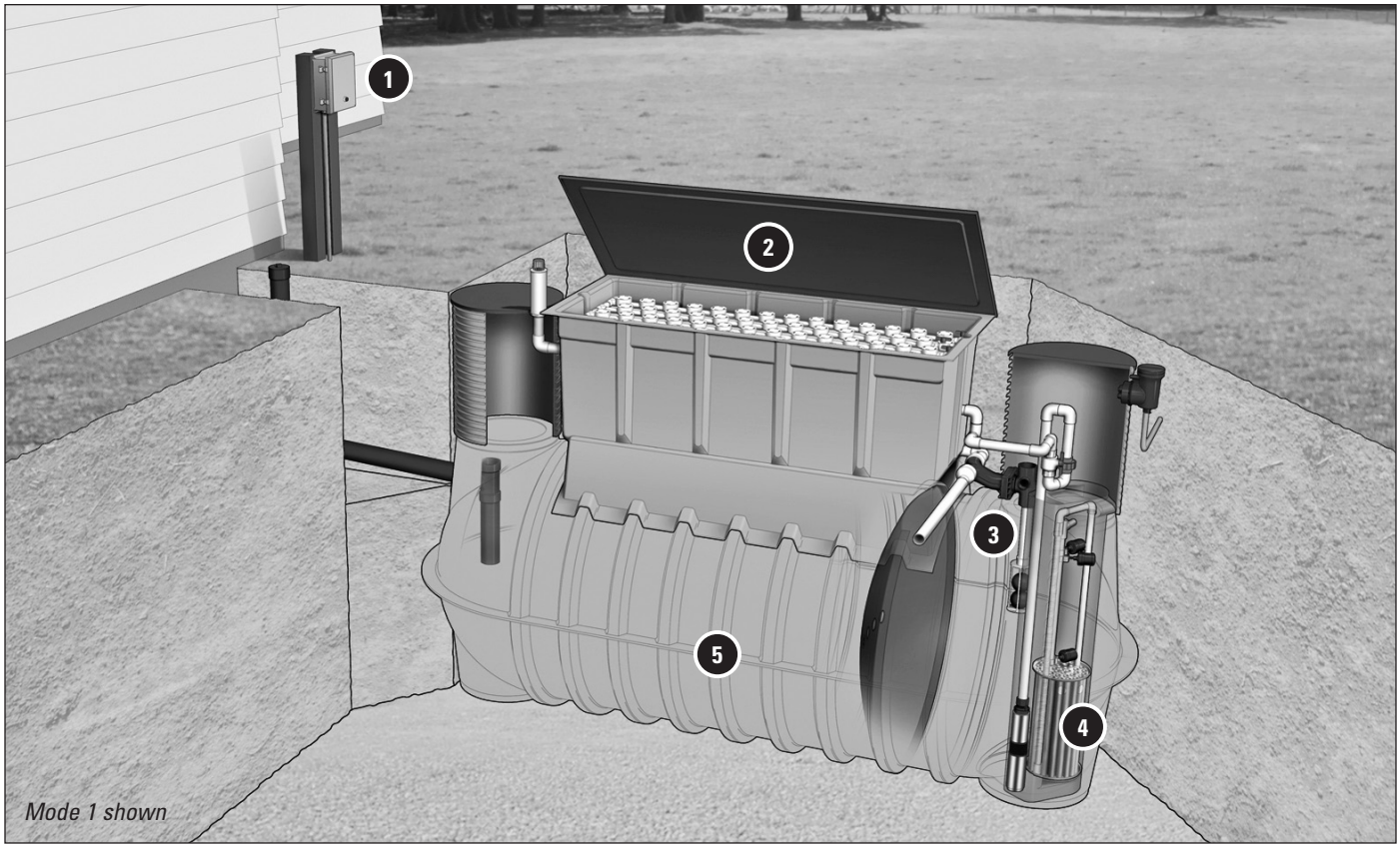
Important Notes

- *All tanks used with AdvanTex Treatment Systems must be prequalified. Call your local Dealer for specifics.*
- *The backwash discharge from a salt-type water softener MUST NOT be plumbed into an AdvanTex Treatment System, or the system's warranty will be void. Contact your AdvanTex Dealer if you have any questions about household plumbing arrangements that may interfere with the functioning of the system.*
- *All pipe diameters given are U.S. nominal IPS pipe sizes. If you are using metric pipe, you may need adapters to connect to the U.S. fittings supplied.*
- *If you are not a trained AdvanTex Installer, contact your local Dealer or Orenco for training before installing this system.*

Overview

The AdvanTex AX20 Treatment System has five main functional units:

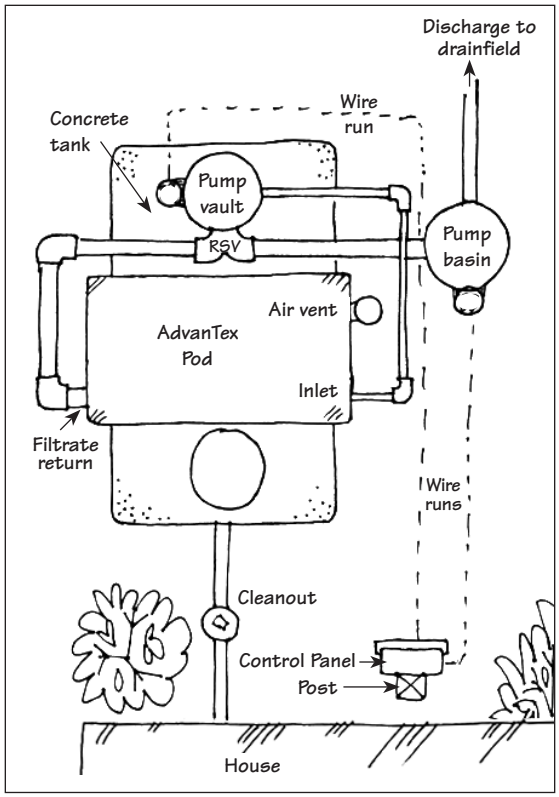
1. Control Panel
2. AdvanTex Filter Pod
3. Recirculating Splitter Valve
4. Biotube® Pumping Package
5. Processing Tank



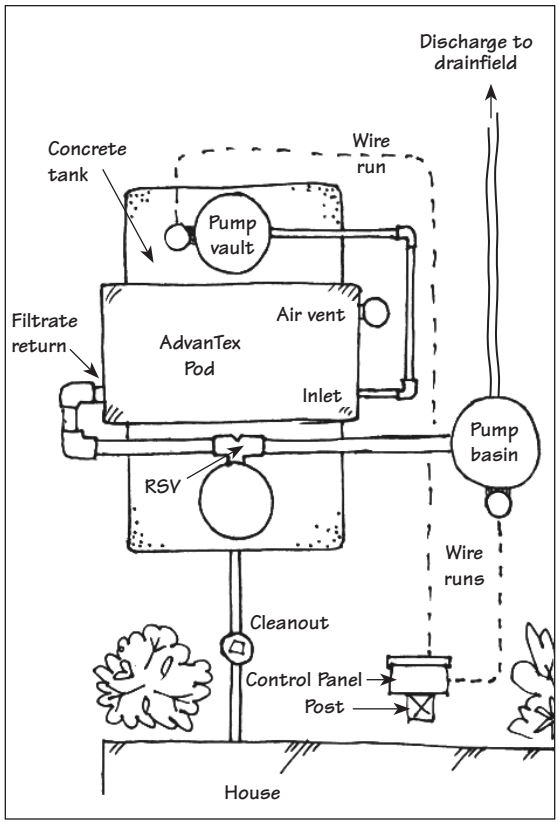
Mode 1 shown

Raw sewage enters the two-compartment processing tank through its inlet tee. In the first compartment, the raw sewage separates into three distinct zones: a scum layer, a sludge layer, and a clear layer. Holes in the tank's baffle wall allow effluent from the clear layer to flow into the second compartment of the tank. The Biotube pump package in the second compartment pumps filtered effluent to a distribution manifold in the AdvanTex pod. Effluent percolates down through the textile media and is collected in the bottom of the filter basin. The treated effluent flows out of the filter pod through a 2-in. diameter pipe that returns the treated effluent to the recirculating splitter valve (RSV). The RSV automatically splits the return flow between the processing tank and the final discharge. The RSV also controls the liquid level within the processing tank. During extended periods of no flow, 100% of the treated effluent is returned to the processing tank.

The operation of the pump in the second compartment is controlled by a programmable timer in the control panel, which allows the pump to dose the filter for short periods (usually a half-minute or less), typically 72 times a day. This frequent "microdosing," which optimizes the treatment process, occurs 24 hours a day, to maintain the proper biological environment.



Sample sketch of a Mode 1 configuration system layout



Sample sketch of a Mode 3 configuration system layout

Step 1: Review or Sketch Site Plans

Before starting the installation, familiarize yourself with the site plans and specifics of your installation. For multipod residential systems, contact your local Dealer for special instructions on layout, installation, and equipment. If you are installing the AdvanTex pod more than 20 feet (6 meters) away from the tank, contact your Dealer or Orenco for assistance.

1a) Detailed Site Plans Provided:

If you are installing the AdvanTex AX20 System according to a set of detailed plans, we recommend that you make sure that the plans you have accurately reflect conditions at the site. If there are differences between the physical site and the plans, we recommend you contact the Designer before scheduling the installation.

1b) No Site Plans Provided:

If you are installing the AdvanTex System without detailed site plans, or with plans of limited detail, the Orenco *AdvanTex Treatment Systems Design/Engineering Package for Residential Applications* can help you design your system layout successfully. For a copy, contact your local Dealer or Orenco.

- *Determine and sketch the exact positions of the tank and AdvanTex pod on the site. If a pump basin is required, sketch the location of the pump basin. (See Appendix 4, "PBAX Pump Basin Installation.") Account for current and likely future landscape features in your sketch.*
- *Be sure to position the tank and pod to allow for a minimum ¼ inch per foot slope (20 mm per meter, or a 2% slope) in the line from the filtrate return at the bottom of the pod to the inlet of the RSV. (See Appendix 3, "RSV and Float Level Diagram.")*
- *Determine and sketch the positions and lengths of your pipe runs and connections in as much detail as possible. During the installation, write down measurements to critical buried elements.*
- *Sketch the placement of the control panel. (See Panel Installation, EIN-CP-GEN-1, for installation recommendations.)*

The AdvanTex pod can be placed in several different positions in relation to the tank. Before determining which position is best, look to see how the filtrate return line needs to be run. Notice that the outlet for the filtrate return line and the inlet for the transport pipe are typically installed on opposite sides of the pod.

Step 2: Excavate and Set Tank

This section covers excavating the hole for the tank and setting the tank. For information on excavating the hole for the AdvanTex pod, see Step 4. For information on excavating the hole for the discharge pump basin, see Appendix 4, "PBAX Pump Basin Installation."

Consider the necessary elevations and grade requirements for the tank and AdvanTex pod before excavating the hole for the tank.

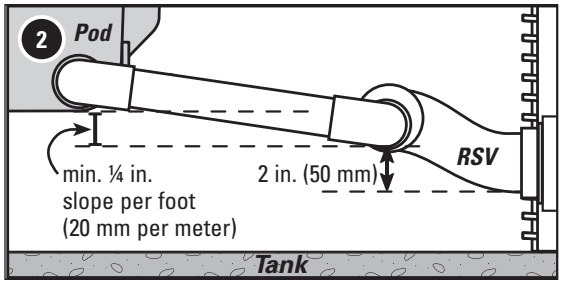
The tank must be set deep enough below the pod to allow for a minimum ¼ inch per foot slope (20 mm per meter, or a 2% slope) from the outlet of the filter to the inlet of the RSV on the riser. (Using an Orenco tank saddle on a concrete tank or on an Orenco fiberglass tank will create the correct slope.) Also, keep in mind that the top of the AdvanTex pod needs to sit 1½ inches (40 mm) above final grade.

If a concrete tank is used or if an Orenco fiberglass tank without a tank saddle is used, you need to calculate how high to elevate the pod above the tank. Variables include:

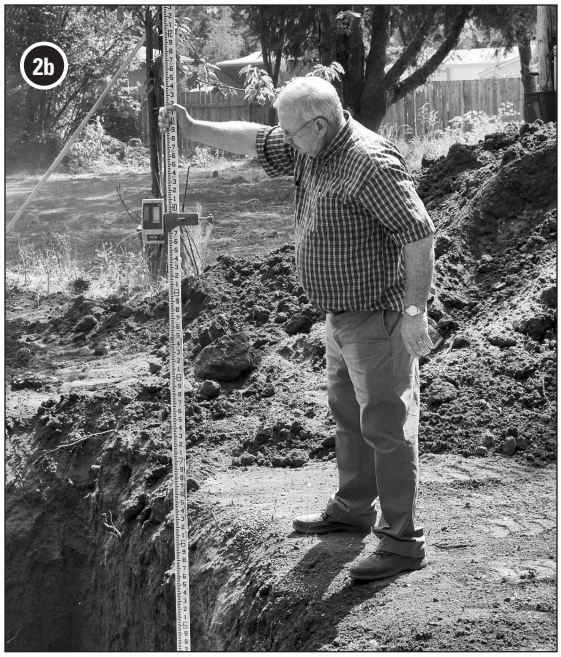
- *Length of the filtrate return line*
- *Type of tank being used*
- *Style of the tank adapter being used*
- *Elevation of the RSV3Q penetration in the riser*
- *Final grade of the site*

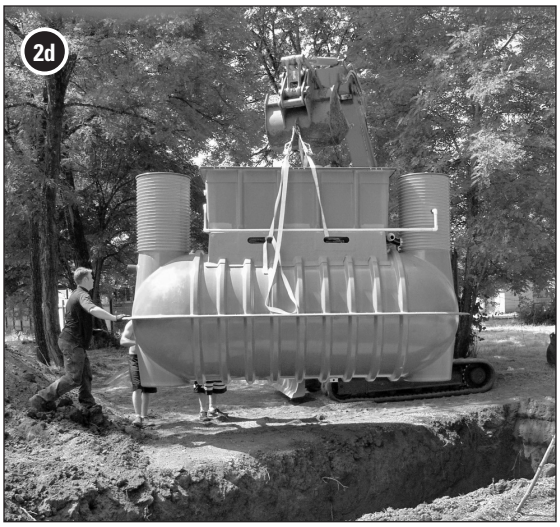
Step 2a: Outline an excavation area (with chalk, paint, string, etc.) for the tank. If you plan to place your discharge basin in the tank excavation, refer to Appendix 4, "PBAX Pump Basin Installation."

Step 2b: Excavate the hole for the tank following the tank manufacturer's recommendations. Remember that you need the correct depth for a consistent ¼ inch per foot slope (20 mm per meter, or a 2% slope) from the filtrate return to the RSV.



Calculate the height of the pod above the tank based on the designed length of your filtrate return line and the installed height of your RSV above the tank.





Place tank on a 4-in. bed of compacted pea gravel in uneven or rocky excavations.

Step 2c: Make sure the bottom of the excavation is free of debris, especially rocks and other sharp objects. If the bottom of the excavation is uneven or rocky, lay a 4-in. (100 mm) bed of sand or pea gravel and compact the material to create an even, smooth surface.

Step 2d: Set the tank following the manufacturer's instructions. Follow the tank manufacturer's guidelines for watertight testing, antiflotation measures, and backfilling to the level of the top of the tank. Do not backfill past the top of the tank at this time.

NOTE: *An AdvanTex pod can be attached to an Orenco FRP tank using an Orenco Fiberglass Tank Saddle. Consult the Fiberglass Tank Saddle Installation Instructions (NIN-SAD-1) or Two Piece Fiberglass Tank Saddle Instructions (NIN-SAD-2), available from the Document Library at www.orenco.com. Some Dealers supply the AdvanTex pod already attached and plumbed (Fully Assembled Package - FAP) so that the tank and the AdvanTex pod can be installed as a unit, as shown in the photos at left. This simplifies installation and saves time.*

Step 3: Install Risers and Water Test Tank

NOTE: *An External Splice Box (if one is used) and a bracket for the Recirculating Splitter Valve (RSV) may come pre-installed on the risers. If not, refer to External Splice Box Installation Instructions (EIN-SB-SBEX-1), and install the external splice box on the riser before the riser is mounted. If you need to install an RSV bracket, refer to RSV3Q Installation Instructions, (NIN-RSV-3), and install the bracket before the riser is mounted. If an Internal Splice Box is supplied instead, follow the instructions in Step 7c to install it after the riser is in place.*

Step 3a: Refer to the Riser Sizing Chart at right to ensure you are installing correctly sized risers for your application. Place the risers with their grommeted holes in the directions shown on your engineering plans. The riser that will have the RSV installed in it (inlet riser for Mode 3; outlet riser for Mode 1) must be installed so that the RSV inlet piping is oriented to accept the filtrate return line. For any risers that will have electrical conduits running to them, try to orient electrical grommeted holes to minimize the number of bends. (National Electrical Code limits the sum of all bends in a run to 360 degrees.)

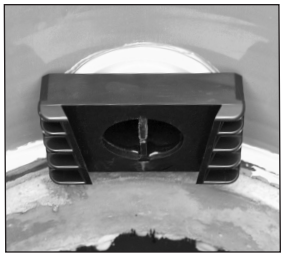
Step 3b: Wipe the areas to be bonded with a clean rag to ensure a clean, dry bonding surface.

Step 3c: To bond the riser to the riser tank adapter, you can use either ADH100 or methacrylate adhesive alone. However, because ADH100 does not provide a structural joint for approximately 24 hours, you may want to use both adhesives. If so, apply methacrylate adhesive to the outside surface of the riser tank adapter for a quick (usually an hour or less) structural joint.

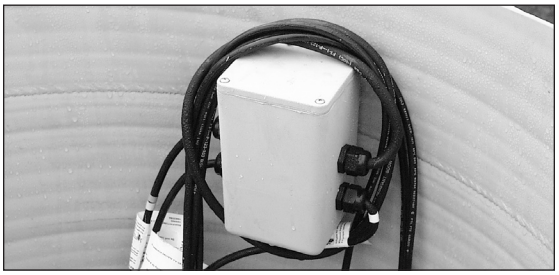
Step 3d: When applying adhesive to the riser with the RSV, apply an additional bead below the RSV bracket before placing the riser on the manway, because once the riser is in position, it is hard to reach under the RSV bracket with an adhesive gun.

** Orenco FRP tanks do not require an adapter. Risers are bonded directly to the tank.*

External splice box



RSV bracket



Internal splice box

Riser Sizing and Tank Opening Chart

	Mode 1	Mode 3
Inlet riser	24 in. (610 mm)	24 in. (610 mm)
Inlet tank opening	19 in. (483 mm)	19 in. (483 mm)
Outlet riser	30 in. (762 mm)*	24 in. (610 mm)
Outlet tank opening	23 in. (584 mm)	19 in. (483 mm)

** Using an External Splice Box and an "earless" PVU (NB option) allows use of a 24-in. outlet riser.*

Methacrylate adhesive

Apply bead of adhesive under RSV bracket

Step 3e: Carefully slide the riser onto the adapter. Correctly orient the riser before the adhesive starts to set.

Step 3f: Apply a bead of adhesive to the inside of the adapter and riser joint; then use a putty knife or similar tool to form a continuous fillet between the tank adapter and the inside of the riser.

Step 3g: After the adhesives have hardened, fill the tank with clean water to a level 2 inches (51 mm) above the adhesive joint in the riser, to test the watertightness of the tank and the riser joint. Do not allow the water level to rise more than 3 inches (76 mm) into the riser because structural damage to the tank may occur. The inlet pipe into the tank needs to be turned up or plugged to allow the tank to be filled.

CAUTION: *Check the tank manufacturer's guidelines before water testing the tank. Some tank manufacturers require a partial or complete backfill before a tank is water tested.*

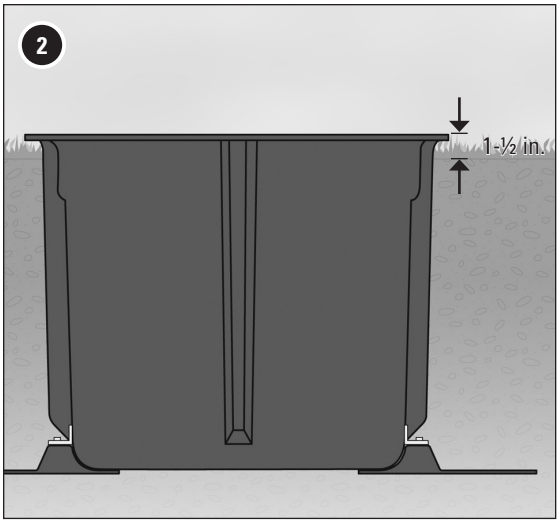
Step 3h: When the tank proves watertight, drain the excess water to about 1 inch above the RSV cage.

Step 4: Excavate and Set AdvanTex Pod

Before installing the AdvanTex pod, consider the depth of the tank and the height of the RSV penetration in the tank riser.

Remember that the pod must be elevated high enough above the tank to allow for a minimum ¼ inch per foot slope (20 mm per meter, or a 2% slope) on the filtrate return line, which runs from the outlet of the filter to the inlet of the RSV.

The top of the pod should also end up approximately 1½ inches (40 mm) above finished grade, to allow for settlement and drainage. Take into account any planned landscaping that might affect the finished grade of the system.



The AdvanTex pod's lid should be 1½ inches (38 mm) above finished grade.

With a Concrete Tank:

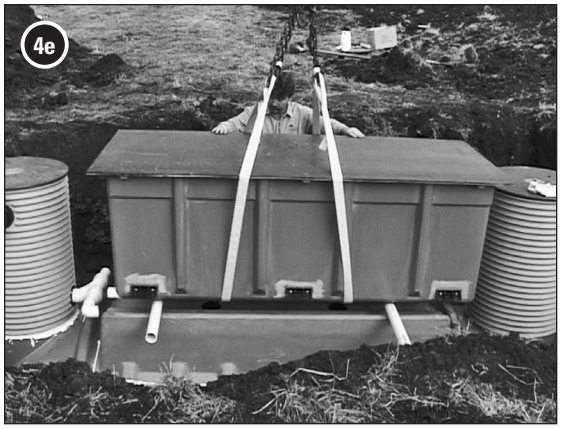
Step 4a: If you are installing the pod directly on top of the tank, follow the tank manufacturer's guidelines for backfilling the tank and place a layer of compacted crushed rock, soil, or sand between the top of the tank and the bottom of the pod in order to get the required slope on the filtrate return line.

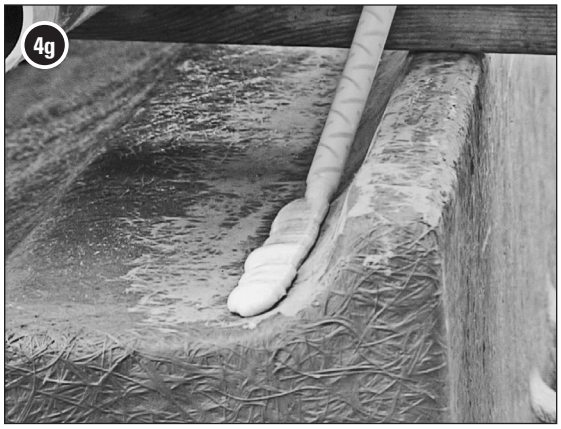
Step 4b: If the pod is not being installed on top of the tank, mark and excavate a hole for the pod. This hole has to be at least 5 ft × 9½ ft (1500 mm × 2900 mm) to accommodate the anti-flotation flanges. For multipod systems, make sure you allow at least 44 inches (1120 mm) between each pod.

Step 4c: Set the pod in place. An AX20 weighs about 350 lb (160 kg) dry. You can lift and set the pod into place by slinging two wide truck straps under the entire unit and lifting it with an excavator, or you can move and set it manually.

IMPORTANT: *To avoid damage to the pod, make sure the lid is closed and secured with the lid bolts before hoisting the pod with straps. DO NOT hoist the pod with straps once the antiflotation flanges are attached! Lower the pod into the hole onto 2 × 4s or similar supports, bolt on the flanges, then remove the 2 × 4s.*

Step 4d: AdvanTex pods come standard with a set of antiflotation flanges. The flanges help prevent the pod from floating out of the ground under saturated soil conditions. (See Step 13, "Backfill the Installation.") The flanges come with predrilled anti-flotation attaching brackets and stainless steel bolts for attaching the flanges to the pod. With the flanges in position under the pod, mark and drill 17/64-in. (7-mm) diameter holes in the flanges to line up with the predrilled holes in the tabs. Use the ¼ - 20 × 1.25 bolts and nuts provided to attach the flanges to the brackets.





With the Orenco Fiberglass Tank and Tank Saddle:

See step 5c through 5f for information on dry fitting and installing plumbing before continuing.

If you're using the Orenco Fiberglass Tank and Tank Saddle, the saddle should be attached to the tank already. If you need to attach the saddle to the tank, refer to *Tank Saddle Installation Instructions* (NIN-SAD-1).* You will not need antiflotation flanges for the pod.

Step 4e: Using a backhoe, lower the pod onto 2 × 4s or sections of pipe and remove the lifting straps.

Step 4f: Sand the bottom edges of the pod that will rest on the pre-sanded areas of the saddle, and wipe them with acetone to prepare them for gluing.

Step 4g: Apply a bead of methacrylate adhesive to the sanded area of the saddle where the pod will rest, moving the pod on its supports as necessary.

Step 4h: Remove the supports one by one and lower the pod onto the saddle, making sure that the pod is completely seated in the saddle.

IMPORTANT: *Attaching the pod to the tank with the saddle adds the pod's buoyancy to the tank's, which in noncohesive soils (see Step 13, "Backfill Installation") makes it necessary to pour a concrete antiflotation collar around the midseam of the tank. Consult a local soils engineer if you are unsure whether a concrete collar is needed. Instructions for pouring the collar are in the* Fiberglass Tank Installation Instructions *(NIN-TNK-1).**

* *These documents are included with the components to which they refer. You can also download them from the online Document Library at www.orenco.com.*

Step 5: Install Filtrate Return and Discharge Lines

NOTE: *All ABS components supplied by Orenco are colored black for easy identification. DO NOT use primer on ABS parts.*

If Using a Concrete Tank:

Step 5a: Dry fit all of the plumbing between the filtrate return on the pod and the split-flow tee using nominal 2-in. PVC pipe and fittings as necessary. We recommend using two 45° or 90° elbows to create the necessary minimum 2% slope (or minimum 1½-in. [38-mm] drop) between the pod outlet and the split flow tee on the RSV. Mark the alignment of the fittings with a waterproof marker.

Step 5b: Glue the pipe and fittings together with ABS/PVC transition cement (IPS Weld-On® 794 or equivalent), starting at the split-flow tee, using the marks to align the parts.

If Using an Orenco Fiberglass Tank and Tank Saddle:

Step 5c: Set the pod onto the saddle without adhesive and dry-fit the plumbing. Mark the alignment of the fittings with a waterproof marker.

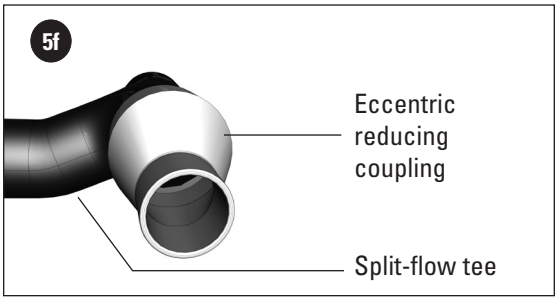
Step 5d: Follow the steps for installing the pod on the saddle as described in Steps 4e to 4h.

Step 5e: While the adhesive is wet, glue the fittings together with ABS/PVC transition cement (IPS Weld-On® 794 or equivalent), starting at the split-flow tee, using the marks to align the parts. As the last step, apply cement to the outlet of the pod and the pipe elbow, slide the pod back toward the RSV on the wet adhesive, and connect the fittings.

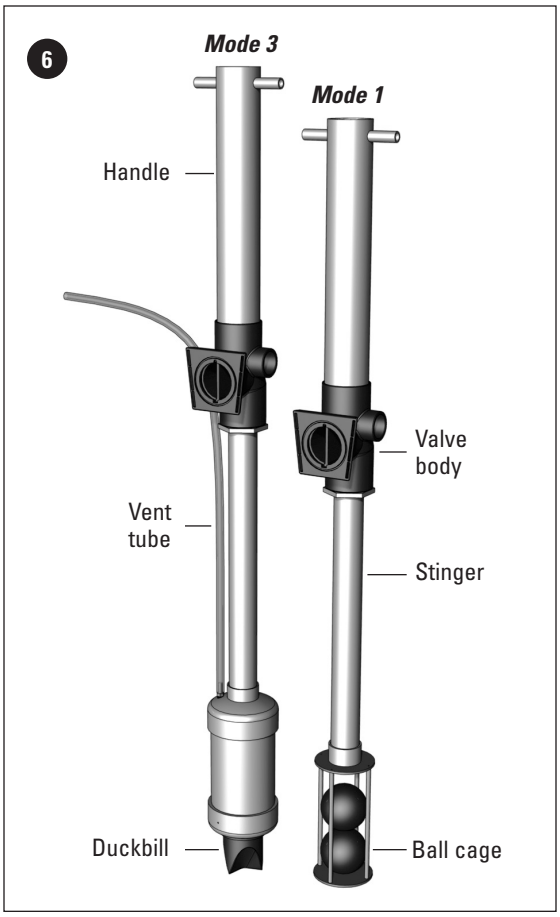
For All Installations:

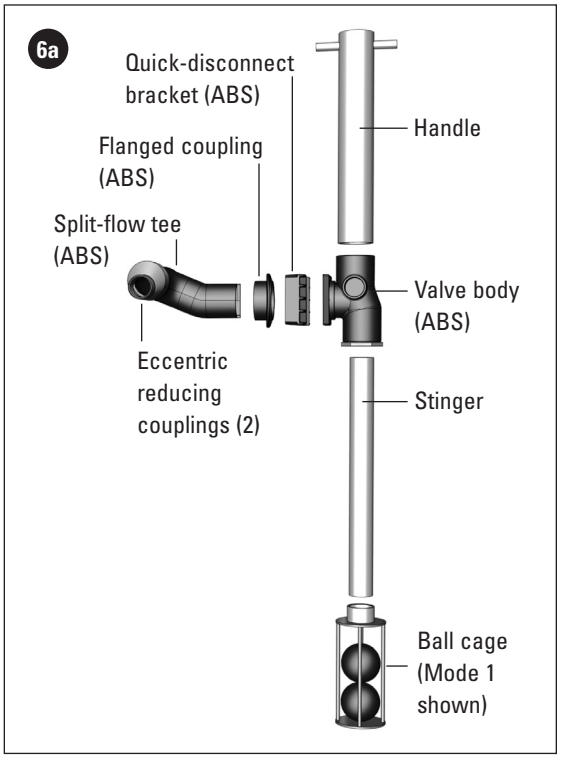
Step 5f: Connect the 2-in. discharge line from the split-flow tee to the pump basin or to the dispersal area, maintaining a minimum ¼ inch per foot slope (20 mm per meter, or a 2% slope). Be careful not to create low spots where liquid can pond.

On the split flow tee, orient the eccentric reducing couplings so the small end is at the lowest point possible, as shown in the illustration to the right. Refer to Appendix 4 in this document for more information about installing the pump basin.



Orient the eccentric reducing coupling





Step 6: Install Recirculating Splitter Valve

The Recirculating Splitter Valve (RSV) controls the recirculation of effluent returning from the AdvanTex filter pod. Floating balls in the valve rise and fall with the level of liquid in the tank. If the level is high, the valve directs effluent to the dispersal system. If the level is low, effluent returns to the tank for further treatment.

For systems operating in **Mode 1**, the recirculating splitter valve (RSV) is installed in the riser over the tank's second compartment (or in the inlet riser of the second tank in a two-tank installation). Whenever possible, the RSV should be installed between the baffle wall and the pump system to ensure mixing of the return effluent.

For systems operating in **Mode 3**, the RSV (duckbill model) is installed in the tank's inlet riser. The RSV must be installed so as not to interfere with the inlet tee.

Step 6a: Verify that you have all the pieces of the RSV: the handle pipe, body, quick-disconnect bracket, flanged coupling and eccentric reducing couplings, split-flow tee, stinger pipe, and RSV cage. The body and cage will be different depending on whether you are installing the Mode 1 or Mode 3 model.

IMPORTANT: *The RSV bracket should have been installed before the riser was installed. If it hasn't been installed, install it now, following the instructions supplied with it (NIN-RSV-3)*.*

Step 6b: The RSV comes with an 18-in. (457-mm) long stinger pipe. Determine the correct stinger length for your installation and shorten or lengthen the pipe if needed. If the low liquid level is not specified for the particular installation, refer to Appendix 3 of this manual for typical RSV and float settings. (The normal low liquid level — the level at which 100% of the filtrate returns to the tank — determines the stinger length.)

For almost all applications, the stinger will be shorter than 24 in. (610 mm), and the low liquid level will be approximately 6 inches (152 mm) below the top of the RSV cage. For stingers longer than 36 inches (914 mm), Mode 1 RSVs require a different top plate for the ball cage and Mode 3 RSVs require a different seating grommet for the ball cage. Contact your Dealer or Orenco for more information.

IMPORTANT: *Correct stinger length is critical to the proper operation of the system!*

* *This document is included with the component. You can also download it from the online Document Library at www.orenco.com.*

Step 6c: After you've cut the stinger pipe to the correct length, attach it to both the RSV cage and the RSV body using PVC cement.

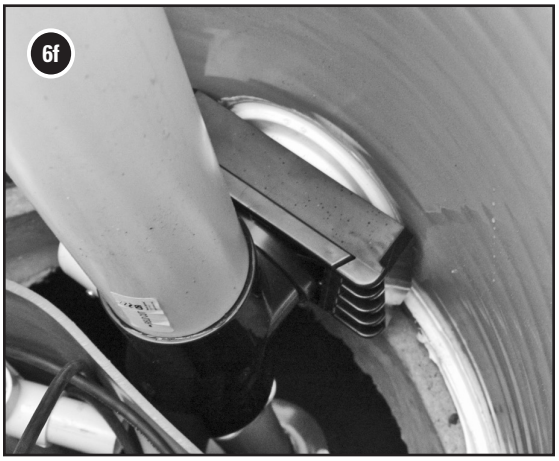
IMPORTANT: *Some RSV3Q parts are ABS and others are PVC. All ABS components are colored black for easy identification. Use all-purpose ABS/PVC transition cement (such as IPS Weld-On® 794) to join them. Do not use primer on ABS parts.*

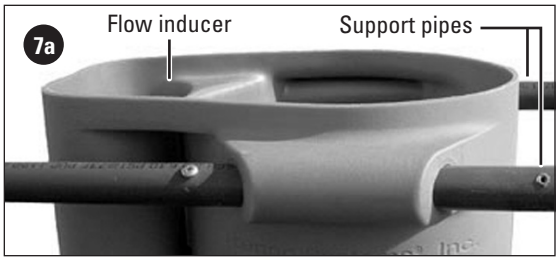
Step 6d: Mode 3 installations require the duckbill model RSV, which has a flexible PVC tube that vents the RSV cage to atmosphere. Push the flexible PVC tube onto the insert fitting on the cage. Thread the other end of the tube through the tube holder at the top of the RSV body. Leave about 6 inches (152 mm) of tube extending through the tube holder. Any excess can be cut off.

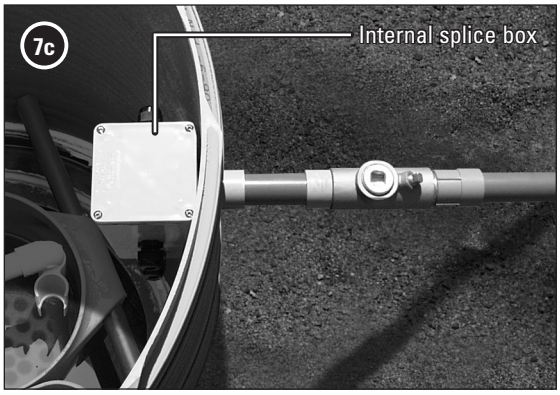
Step 6e: If your riser is less than 30 inches (762 mm) high, shorten the handle as needed by cutting out the excess. Then glue it into the top of the RSV body with ABS/PVC transition cement, such as IPS Weld-On 794. Orient the handle crosspiece so that it will be close to the side of the riser instead of sticking out into the middle.

Step 6f: Push the RSV body down into its bracket until the valve body is flush or almost flush with the bracket. Use your weight to push it down, and then wiggle it till you're sure it's snug.

Completed installation shown.







Step 7: Install Biotube® Pump Package

The Biotube pump vault holds the Biotube effluent filter and a high-head pump. Your vault may have support pipes to allow it to hang from the rim of the tank at the bottom of the riser, or it may be an "earless" vault designed to rest on the bottom of the tank.

Step 7a: If your vault includes support pipes, detach them from the packaging material, and remove one of the two screws from each pipe. Slide the support pipes through the holes in the support brackets at the top of the vault. Reinstall the screws.

Step 7b: Gently lower the vault into position in the access riser. If there are support pipes, they should rest on top of the tank, and if the vault is earless, it should rest on the tank bottom.

Step 7c: A splice box houses the connections for the pump and float switches. Either an internal splice box or an external splice box can be used.

If an external splice box is being used, it should be installed before the riser is installed. If not, refer to *External Splice Box Installation Instructions* (EIN-SB-SBEX-1), and install the external splice box.

If an internal splice box is being used, install it now. To install an internal splice box into an access riser, lubricate both the outside of the conduit coupling and the grommet with pipe lubricant or an equivalent product and slide the coupling through the grommet until the box is snug against the riser wall. Use a conduit seal to ensure condensation does not affect the system.

* *This document is included with the component. You can also download it from the online Document Library at www.orenco.com.*

Step 7d: Screw the discharge assembly into the pump. Carefully lower the pump and discharge assembly into the flow inducer of the Biotube pump vault.

IMPORTANT: *To avoid damage to the pump and pump electrical cord, DO NOT use the cord to lower the pump!*

Step 7e: Using pipe lubricant or an equivalent product, lubricate the access riser grommet and the gray nipple on the discharge assembly. Push the nipple through the grommet and orient the discharge assembly to make component removal for maintenance easy.

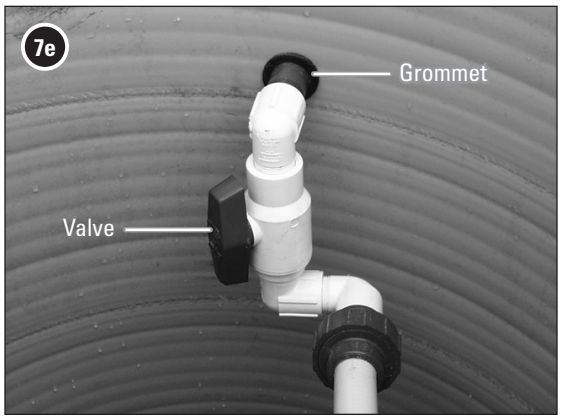
Step 7f: Although float switches are set at the factory for the appropriate depths, compare the float settings with the project plans and specifications to make sure the settings are correct. If you need to adjust a setting, refer to Appendix 3 at the end of this document for typical RSV and float settings for residential systems.

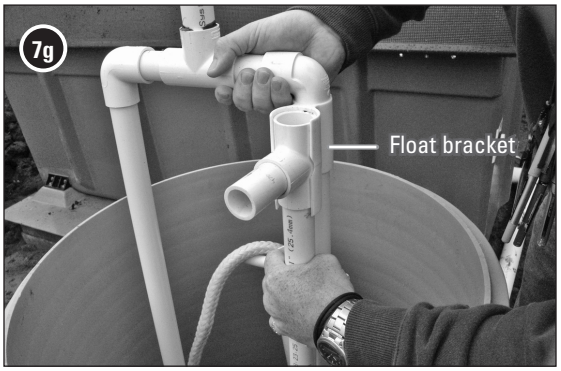
Step 7g: Insert the float switch assembly into the float bracket on the Biotube filter handle. Make sure you can detach it without removing the Biotube cartridge or pump vault.

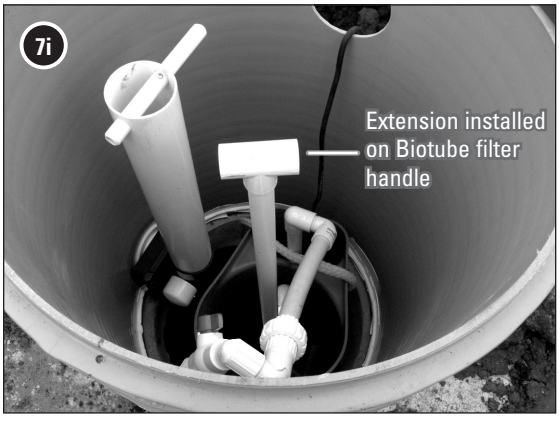
Step 7h: If you have an "earless" vault with a lifting rope, coil the rope neatly and secure it to the splice box along with the float cords so that it does not fall into the vault or interfere with the floats.

Step 7i: Make sure that the components are arranged in the riser so that you can pull out the Biotube filter cartridge and the float stem without having to disconnect anything. Extending the Biotube cartridge's handles with 1-in. pipe and extending the float stem in the same way will make maintenance easier.

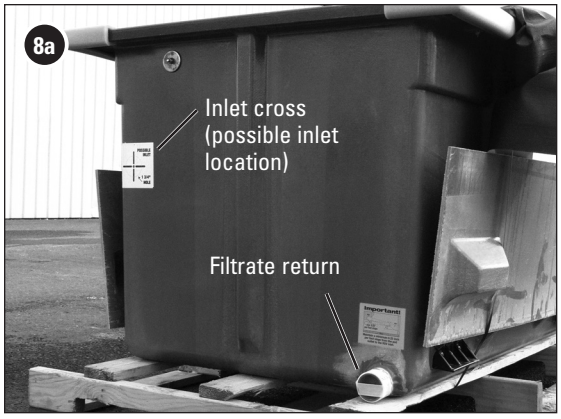
NOTE: *Refer to* ProSTEP Effluent Pump Packages Installation Guide *(NIM-EPS-1) for more detailed pump package installation instructions.**

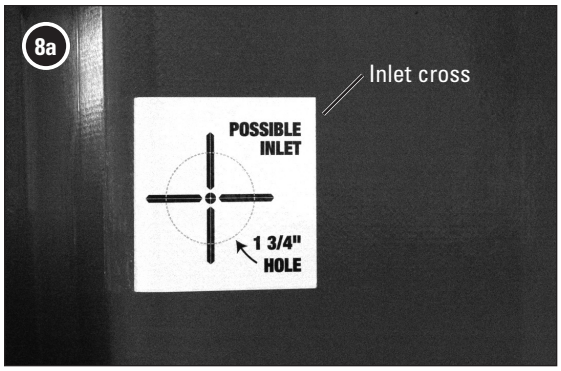


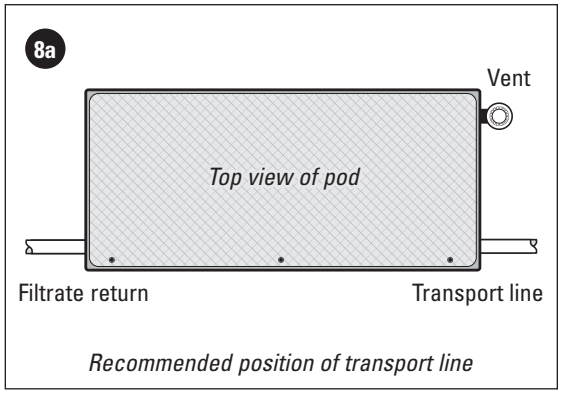




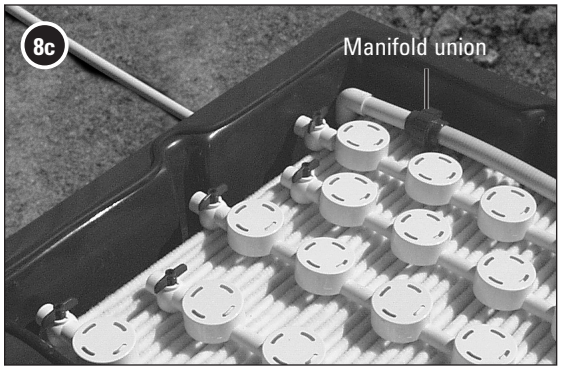
* *This document is included with the component. You can also download it from the online Document Library at www.orenco.com.*







Recommended position of transport line



Step 8: Connect Transport Line to Pod

The transport line conveys effluent from the discharge assembly to the pod. The transport line can be connected to either end of the AdvanTex pod. We recommend installing it in the end opposite the filtrate return — on the same side as the passive air vent — to facilitate cleaning.

Step 8a: Determine which possible inlet location you are installing the transport line into, and cut a 1¾-in. (44.5 mm) hole in the pod where it is marked with a cross. (If you are using piping other than U.S. nominal 1-in., measure your grommet and cut the hole to fit.) Remove any burrs and install the 1¼-in. grommet, sealing it in place with ADH100 adhesive.

Step 8b: From the inside of the pod, insert the lower manifold elbow through the grommeted hole, and connect the 1-in. transport line from the discharge assembly to this elbow. In cold weather installations, slope the line so that it drains back to the tank after every cycle. We recommend installing a coupling on the transport line outside the pod next to the grommet to prevent the line from being pushed into the pod during installation or maintenance.

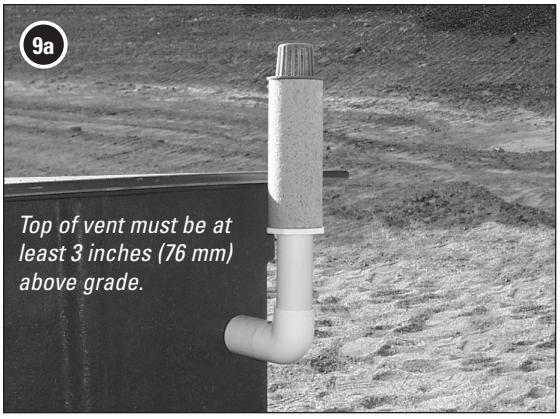
Step 8c: Temporarily disassemble the manifold union so that, when the pump first comes on during start-up, any debris in the transport piping will not be pumped into the manifold (which could then require orifice cleaning).

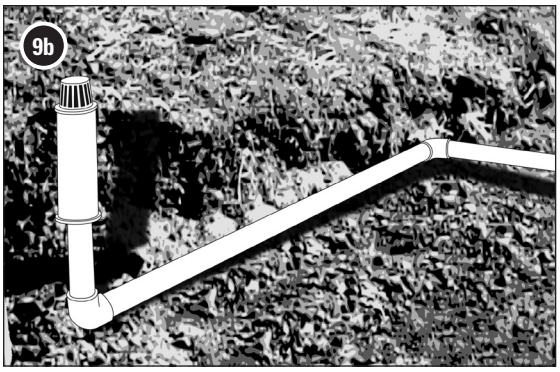
Step 9: Install Passive Air Vent

Step 9a: Using 2-in. PVC pipe, plumb the passive air vent to the 2-in. fitting that protrudes through the filter wall. Be sure the vent line is sloped to drain towards the pod, to prevent accumulation of water in the vent line. And remember that the top of the vent must be at least 3 inches (76 mm) above grade.

Step 9b: We recommend installing the air vent near a wall or in a similar location where it is less likely to be damaged by a lawn mower or accidental kicking, etc. You can easily hide the air vent behind shrubbery or other landscaping and paint it if another color is desired.

IMPORTANT: *In all cases, the line between the air vent and the pod must be sloped back ¼ inch per foot (20 mm per meter) toward the pod. To prevent accumulation of water, do not allow any "bellies" or low points in the vent piping. Keep the 2-in. vent piping less than 20 ft (6 m) in total length.*





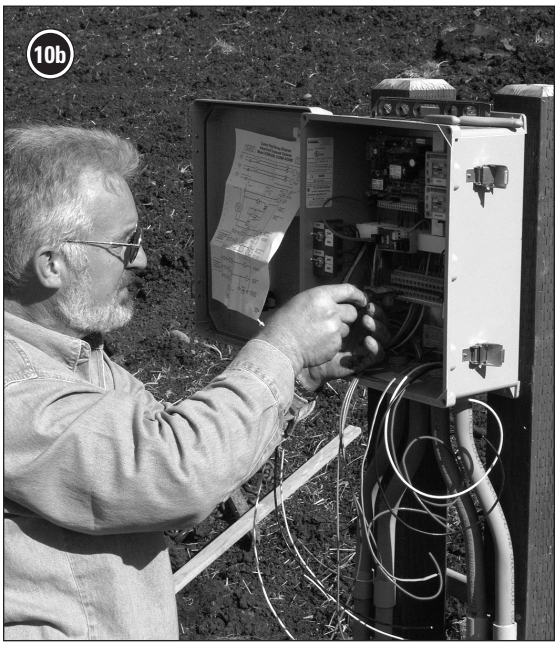
Step 10: Install Control Panel

For complete control panel installation instructions, see the installation manual for the electrical control panel that comes with your system. These instructions ship with the control panel and hang from a clip on the inside of the panel door.*

Step 10a: Make sure the instructions and the items supplied conform to state and local regulations.

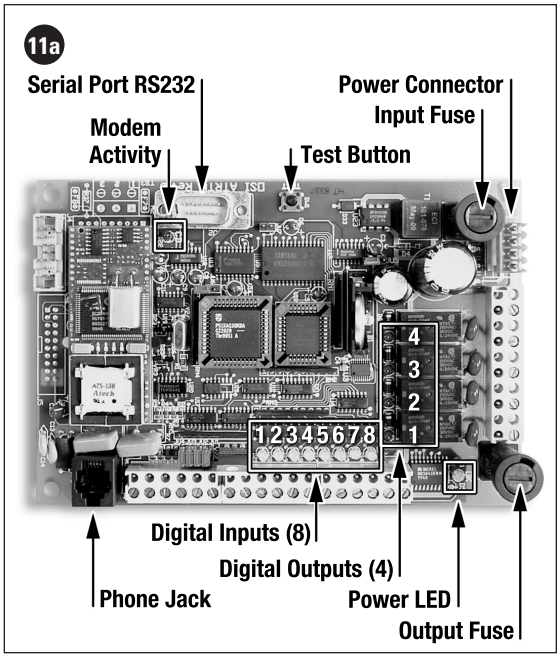
Step 10b: A qualified and licensed electrician should install and service the panel and ancillary wiring in compliance with the National Electrical Code, as well as state and local codes. (Wiring diagrams can be found in the installation manual* that comes with the panel.) Wiring will include the following items:

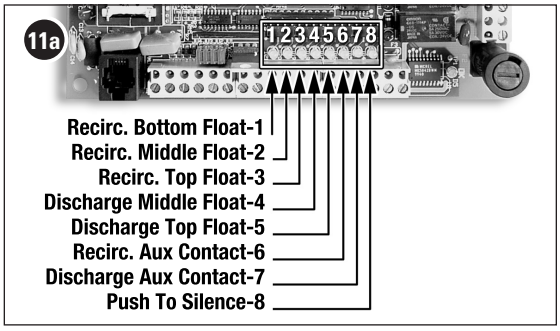
a) Incoming power to the panel. One or more circuits may be required, depending upon the number of pumps and local electrical codes.
b) Incoming phone line to the panel (for VeriComm).
c) Wiring from the control panel to the pump and floats.
d) Wiring to a discharge pump and floats (if applicable).



NOTE: *We do <u>not</u> recommend installing a control panel against the wall of a bedroom, living room, or other living space because it makes a periodic thump during operation. If it must be placed near the house, mount it on 4 × 4 (100 × 100 mm) pressure-treated post(s) next to the wall.*

* *If the instructions are missing or have been removed from the door pouch inside the control panel, call Orenco for a replacement or download a copy of the instructions from our online Document Library at www.orenco.com.*





Step 11: VeriComm® Control Panel Functional Test

VeriComm® (VCOM) telemetry-enabled control panels are the standard panels used with AdvanTex Treatment Systems (although MVP control panels are available in some markets).

With a VeriComm telemetry-enabled control panel, fault conditions are automatically reported to the VeriComm Monitoring System, making the wastewater system virtually invisible to homeowners. If fault conditions are not responded to, then local alarms may be activated, as a back-up.

NOTE: *Each Orenco control panel comes with panel-specific information and instructions on wiring, timer settings, and operating instructions. For more detailed procedures specific to each panel model, refer to the documentation that comes with the panel.**

Follow the procedures in this step to verify proper installation of the VeriComm panel.

Step 11a: Familiarize yourself with the components of the telemetry control board.

Step 11b: Make sure the panel has been completely and correctly installed, and verify that the circuit breakers are in the "On" position. Also check the controller status. The "Power LED" located on the control board will be:

- *Blinking, which indicates the controller is operating normally, or*
- *Off (when power is applied), which indicates a possible problem with*
  - *~ the input fuse on the PC board;*
  - *~ the main fuse located inside the panel;*
  - *~ the controls circuit breaker located inside the panel; or*
  - *~ the incoming line voltage.*

Step 11c: To enable Test Mode, hold the "Push-To-Silence" button on the front of the panel until the audible alarm sounds (approximately 15 seconds).

- *The appropriate digital input should be illuminated when the button is held in.*
- *When the audible alarm sounds to indicate that the panel is in Test Mode, release the button.*

While in Test Mode, the panel will operate as described below:

- *The call-in function is disabled;*
- *Local audible and visual alarms are activated as alarm conditions occur;*
- *System Data Logs are suspended; and*
- *Timer cycles are shortened.*

* *If the instructions are missing or have been removed from the door pouch inside the control panel, call Orenco for a replacement or download a copy of the instructions from our online Document Library at www.orenco.com.*

Step 11d: Familiarize yourself with the floats on the system.

Step 11e: Verify that the pump is submerged in water before continuing. If the bottom float drops, the alarm should sound. Press down the spring-loaded "MAN/AUTO" switch located inside the panel. The pump should immediately activate. For verification, the appropriate digital input should illuminate, indicating that the auxiliary contact is on.

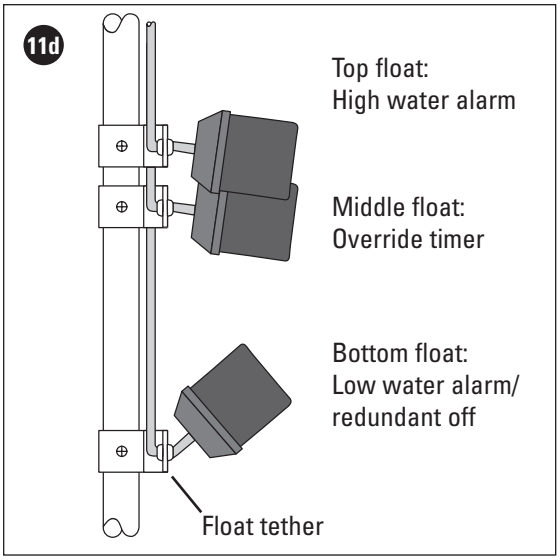
Measure the voltage and amperage of the pump.

a) Measure the voltage at the pump terminals in the panel. Measuring the voltage with the pump off will confirm that the correct voltage is connected. Then activate the pump by flipping the MAN/AUTO switch to MAN, or using a PDA or laptop with the Bluetooth Device, and measure the voltage while the pump is running. The maximum recommended voltage drop is 3%. A low voltage condition may indicate that the site wiring is improperly sized.

b) Using a loop ammeter, place the ammeter clamp around the loop of wire located above the pump circuit breaker and read the amperage while the pump is running and connected to the discharge assembly with the valves at the end of the laterals closed. The amperage should be within the specifications of the pump.

Step 11f: Refer to the control panel documentation to test the floats that activate/deactivate the pump. To perform the float test, make sure there is enough liquid in the tank. If there isn't enough liquid in the tank, turn the pump circuit breaker off.

***NOTE:** If phone service to the panel is active, complete step 11g. If not, proceed to step 11h. However, phone service should be activated before system start-up.*



VeriComm® Recirculating Float Assembly shown

Measure voltage

Measure amperage

* *If the instructions are missing or have been removed from the door pouch inside the control panel, call Orenco for a replacement or download a copy of the instructions from our online Document Library at www.orenco.com.*

Step 11g: Press and release the "Push-To-Silence" button 15 times within a one-minute period. This instructs the panel to call the VeriComm Monitoring System.

- *A red LED ("Modem Activity" component) should illuminate, indicating that the controller has established communication with the host. (This may take a few minutes.)*
- *Once the communication session has ended, the modem will automatically disconnect.*
- *If the LED does not illuminate within the specified time, verify that the phone line has a dial tone. This can be done by hooking up a phone to the line that is going into the panel.*

Step 11h: The panel will automatically disable Test Mode and return to normal operation after 30 minutes. To disable Test Mode manually, hold the "Push-To-Silence" button on the front of the panel until the audible alarm sounds (approximately 15 seconds). The appropriate digital input should be illuminated when the "Push-To-Silence" button is held in. When the audible alarm sounds to indicate that the panel is no longer in Test Mode, release the button.

Step 12: System Functional Test

Once power is connected to the control panel, follow these steps to prepare systems equipped with VCOM control panels for operation. For information on functional testing of systems equipped with an MVP control panel, contact your Dealer or Orenco.

Step 12a: For Mode 1B and 3B installations, fill the pump basin with water to a level just below the lowest float.

Step 12b: Verify both manual and automatic operation of the recirculation pump. Before running the pump, ensure that the tank's water level is at least 4 inches (102 mm) above the bottom float, but below the top float. *Be sure that you have temporarily disconnected the manifold union.* Hold the toggle switch in the control panel on "Manual" to test manual operation of the pump and clear any debris in the transport piping.

Step 12c: Reconnect and hand-tighten the manifold union. Verify that all the lateral ball valves are open, and run the pump in the "Manual" position for 5 or 10 seconds to flush any construction debris out of the manifold piping. Completely close all lateral valves after flushing is complete. With the pump still running manually, remove several orifice shields and measure the squirt height with a tape measure. The squirt height should measure approximately 3-5 ft (0.9-1.5 m). Windy conditions will cause the squirt heights to measure less.

NOTE: *If the desired squirt height is not achieved or the system does not pressurize, check for debris, breaks, or closed valves. Also verify that the pump is receiving sufficient power. If the system still does not pressurize correctly, contact your Dealer or Orenco for technical assistance.*

Step 12d: For more accurate residual head measurements, attach a piece of clear PVC to the end of the lateral. Record the residual head measurement at start-up and before and after servicing.

Step 12e: Return the MAN/AUTO switch to "Automatic." To facilitate quick testing of the automatic operation, put the panel into Test Mode.

IMPORTANT: *Before using a generator to operate a pump, contact Orenco or your Dealer to make sure it can supply sufficient starting amperage.*

Step 12f: Make sure the tank is filled with clean water up to a level about 1 inch (25 mm) above the RSV cage. At this point the water level should be well above the bottom float. In the control panel, turn on the pump by holding the toggle switch in the "Manual" position. As water begins running through the system, ensure proper drainage through the filtrate return line and RSV. All or some of the return filtrate flowing to the RSV should be exiting the system through the final discharge line. Check that no water is leaking at any of the plumbing joints.

Step 13: Backfill Installation

IMPORTANT: *When backfilling, be careful not to alter the slope of pipes. Brace the pipes or place the pipes on a compacted bed and carefully fill around them.*

NOTE: *Before backfilling, make sure all pod and riser lids are bolted down.*

Step 13a: Backfill the tank excavation if you haven't done that yet. Follow the tank manufacturer's guidelines for backfilling up to the height of the tank.

Step13b: Backfill the discharge basin, if you haven't done that yet. For installations in areas with high water tables or with non-cohesive soils, follow guidelines in Appendix 4.

Step 13c: Backfill and compact around the AdvanTex pod in maximum 12-in. (305-mm) lifts. Native material is acceptable if there are no large or sharp rocks that may damage the filter walls. If native material is not usable, backfill with sand or pea gravel.

For installations in non-cohesive soils* with high seasonal water tables, use ¼" crushed rock as the backfill material.

Step 13d: Slope the ground away from the pod to prevent surface water from ponding on or around the pod.

Step 13e: Make sure all lids are secured before leaving.

IMPORTANT: *After backfilling, call the system's Service Provider to arrange for the official System Start-up.*

* *As described in OSHA Standards (29 CFR, Part 1926, Subpart P, Appendix A), noncohesive soils or granular soils include gravel, sand, or silt with little or no clay content. Granular soil cannot be molded when moist and crumbles easily when dry. Cohesive soils include clayey silt, sandy clay, silty clay, clay, and organic clay. Cohesive soil does not crumble, can be excavated with vertical sideslopes, is hard to break up when dry, and when moist, can be rolled into threads without crumbling. For example, if at least a 2-in. (51-mm) length of 1/8-in. (3-mm) thread can be held on one end without tearing, the soil is cohesive.*

Appendix 1: *AX20 Timer Settings Worksheet*

The following chart shows recommended timer settings for a new system.

RESIDENTS	TIME ON (SEC)	TIME OFF (MIN)	NOTES
2	0.2 min (12 sec)	19.8	• Assumes water usage of 50 gal. (190 L) per person per day and a return recirculation ratio of 3 : 1 (Filter recirculation ratio of 4 : 1). • Override OFF cycle time is set at one-half of the OFF cycle time. Override ON cycle time is set the same as the ON cycle time.
3 or 4	0.3 min (20 sec)	19.7	
5	0.4 min (24 sec)	19.6	
6	0.5 min (30 sec)	19.5	

As you gain experience with a system, you may conclude that you need to make adjustments, sometimes significant ones. This worksheet is intended to help you determine appropriate start-up timer settings (Pump ON, Pump OFF) for a single-pod AX20 system. Typical values and ranges are provided for each parameter. If you have any questions or if your values fall outside the desired ranges on this worksheet, contact your Dealer.

PARAMETER		TYPICAL VALUES	NOTES
	Number of people	3	Range of 2 to 8 people.
	Water usage per person	50 gpd (190 L/d)	Typical daily average is 50 gal. (190 L) per person.
Q_i	Actual daily flow (total)	150 gpd (570 L/d)	(Number of people) × (water usage per person).
R_b R_f	Return recirculation ratio Filter recirculation ratio	3 : 1 4 : 1	You can adjust this ratio (return flow to forward flow) up or down depending on system performance. (Range of 2 to 6.)
	Total daily flow to AX20	600 gpd (2280 L/d)	(Actual daily flow) × (return recirculation ratio + 1). Must be ≤ 3000 gpd (11,370 L/d). Actual flow should not exceed 500 gpd (1895 L/d). (500 gpd × 6:1 R_b = 3000 gpd)
Q_d	Actual pump dose rate	33.3 gpm (126 L/min)	Determine this value by field-testing or by using Orenco's *PumpSelect™*. Start at the low end.
T_d	Pump ON cycle time (dose)	0.25 min	Select a value between 0.17 minutes (10 seconds) and 0.75 minutes (45 seconds).
T_r	Pump OFF cycle time (rest)	19.75 min	See Pump OFF equation below.

PUMP OFF EQUATION **EXAMPLE**

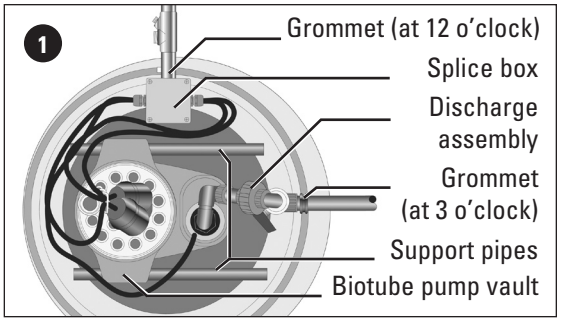
Plugging in the above values and rounding, we get the following:

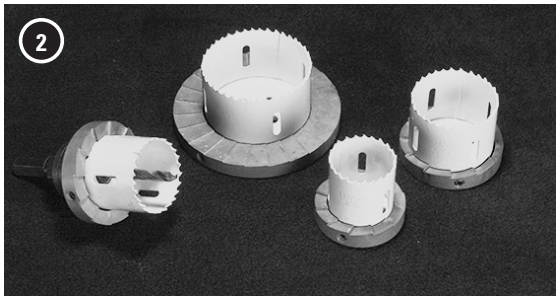
$$T_r = \left[\frac{1440 \cdot T_d \cdot Q_d}{(R_b + 1) \cdot Q_i}\right] - T_d \qquad T_r = \left[\frac{1440 \cdot 0.25 \cdot 33.3}{(3 + 1) \cdot 150}\right] - 0.25 = 19.74 \approx 19.75$$

After you determine your Pump ON and Pump OFF times, double check to make sure your start-up settings fall within the cycle time (CT) range, below. If they don't, make adjustments per the "Note."

ADDITIONAL PARAMETERS		TYPICAL VALUES	NOTES
CT	Cycle time	20 min	Low flow applications may result in cycle times of an hour or more, which can cause the media to dry out or odors to develop in the recirc tank. If CT is much more than 30 minutes, consult your Dealer or Orenco for suggested adjustments.
	Pump cycles per day	72 cycles	1440 min/day ÷ (OFF cycle time + ON cycle time). Must not exceed the pump's maximum rated cycles per day of 300 cycles per day.
	Gallons per cycle	8.3 gal. (31 L)	With 68 orifices and using the Td range recommended above, you will maintain the recommended 0.08 to 0.25 gal. (0.45 to 0.95 L) per orifice per dose.

Appendix 2: *Installing Grommets*





Orenco offers hole saws with pocket cutters in several sizes that make cutting grommet holes simple and easy. These RKHS hole saws cut away the ribs as the hole is cut, eliminating the need to notch and break the riser ribs with an angle grinder and chisel*.

- RKHS100 for 1-in. grommets
- RKHS125 for 1¼-in. grommets
- RKHS150 for 1½-in. grommets
- RKHS200 for 2-in. grommets

Step 1: To install grommets in the field, first mark the riser for location of the grommets. (For Perma-Loc risers, you should try to avoid cutting through the pipe seam — the extra thick rib — unless it is unavoidable.)

Step 2: Using the correctly-sized RKHS hole saw and a drill of at least 18 volts, cut the hole and grind the ribs down until you have a flat, smooth surface for installing your grommet. Do not grind too deeply into the riser — about 1/16 inch is sufficient.

Step 3: Use a wire brush to clean up the cut, then a deburring tool or knife to deburr the edges of the opening, being careful not to enlarge the opening.

Grommet Hole Saw Sizing Chart

Grommet Size (in.)	Hole Size (in.)
½	1
¾	1¼
1	1 9/16
1¼	1¾
1½	2 1/8
2	2¾
3	3 7/8
4	5

NOTE:
Grommet size = nominal (IPS) pipe size. For more information about grommet dimensions and actual pipe O.D., see Orenco's Grommet Submittal (NSU-RLA-PG-1), available from the Document Library at www.orenco.com.

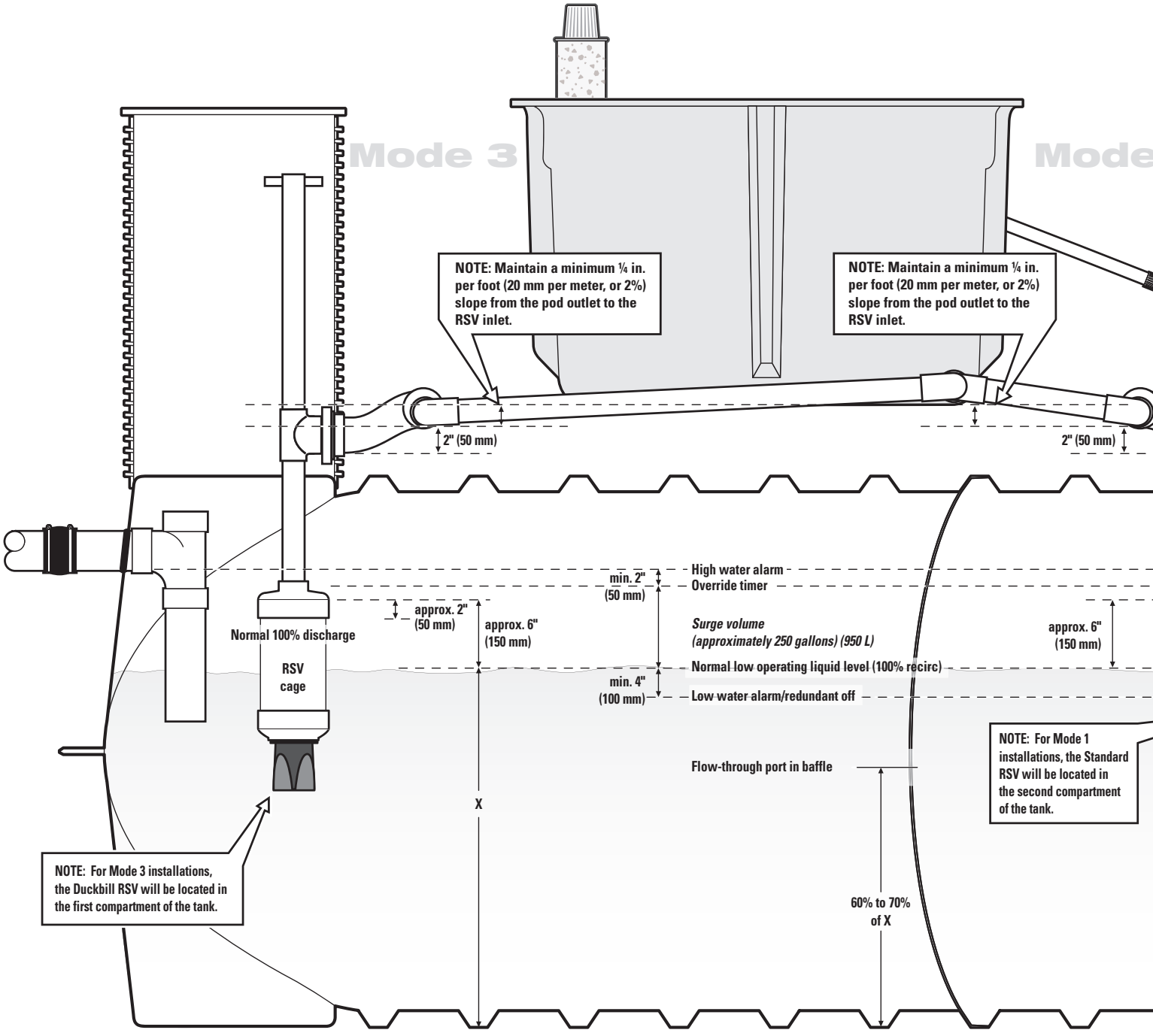
Step 4: Install the grommet in the riser. Apply a bead of ADH100 adhesive to the groove of the grommet prior to insertion into the riser hole. This will make the grommet more secure and will overcome any imperfections in the drilled hole.

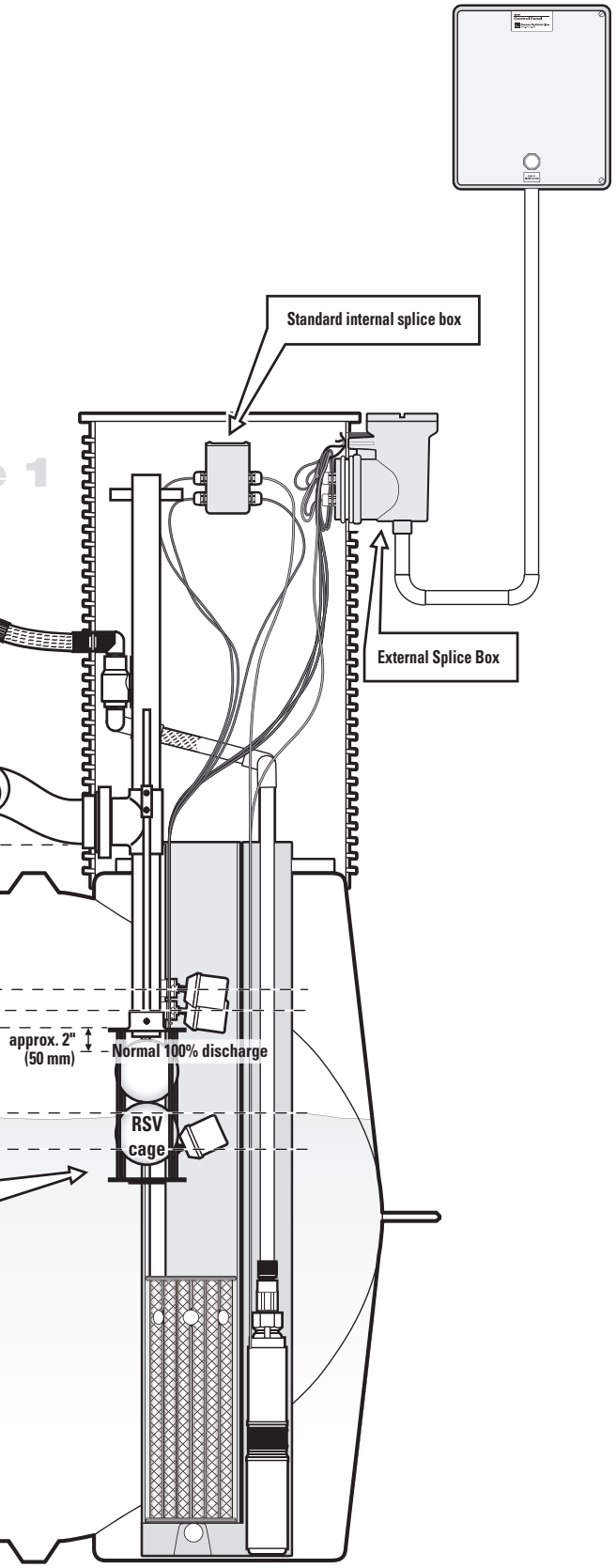
* *If you don't have an Orenco RKHS hole saw and you have to use an angle grinder and chisel to break the riser ribs, refer to* Grommet Installation Instructions *(NIN-RLA-G-1). This document is included with the riser. You can also download it from the Document Library at www.orenco.com*

Appendix 3: *RSV and Float Level Diagram*

This diagram shows RSV and float levels for a system that uses a VeriComm Control Panel. With an MVP Control Panel, a two-float configuration is used (the high water and override floats are combined), and therefore this top combination float may be located 1-2 inches (25-51 mm) below the invert of the inlet.

This diagram shows both a Mode 1 and a Mode 3 setup. For Mode 1 setups, the recirculating splitter valve (RSV) is installed in the second compartment, with the Biotube pump vault. For Mode 3 setups, the RSV is installed in the first compartment, under the inlet riser.





Determine the RSV Level

For stinger pipe lengths up to 24 inches (610 mm) long, the "normal low operating liquid level" will be approximately 5-6 in. (127-152 mm) below the top of the RSV cage. (The normal low operating liquid level is the level at which 100% of the filtrate returns to the tank.) For most residential applications, the recommended surge volume — the volume between the low liquid level and the high water alarm float — is approximately 250 gal. (948 L). For Mode 3 installations, the duckbill model RSV, which has a flexible PVC tube that vents the RSV cage to atmosphere, is required.

Determine the Float Levels

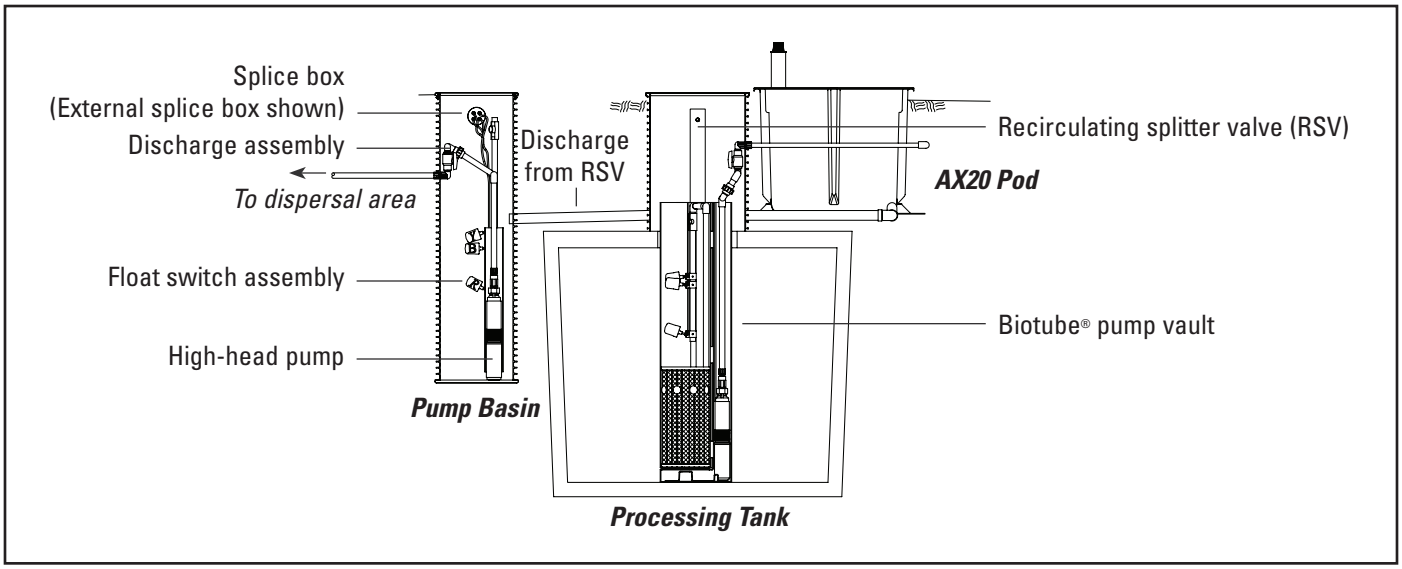
Be sure to check the plans for any site-specific or tank-specific float settings. The top float is normally set equal with the tank's invert of inlet. The bottom float should be approximately 4 inches below the normal low operating level.

NOTE: *Before leaving the site, verify that the "low water alarm/ redundant off" float is positioned at least 10 inches (254 mm) below the top of the RSV cage.*

Appendix 4: *PBAX Pump Basin Installation*

In AdvanTex® Treatment Systems, the Recirculating Splitter Valve (RSV) discharges treated effluent via gravity. If the dispersal area requires the use of a pump, the RSV discharges to a PBAX Pump Basin. From there, a high-head pump delivers it in doses to the drainfield.

Typically, the PBAX consists of a 24-in. (600-mm) pump basin equipped with a high-head pump, a float switch assembly, a splice box, a discharge assembly, and a lid.



Step 1: Plan the Installation

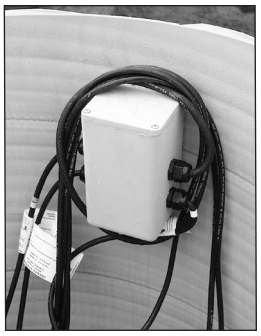
The PBAX Pump Basin is typically installed near the AdvanTex system. For ease of installation, the excavation for the pump basin can be connected to the excavation for the tank as shown in the illustration, so that the bottom of the pump basin's hole is accessible.

NOTE: *If groundwater will rise above the bottom of the pump basin at any time, you will need to set the pump basin in a concrete collar to counteract its buoyancy. The collar should extend at least 6 inches (150 mm) around the basin, and be at least 6 inches (150 mm) deep.*

Step 2: Install the Splice Box (if necessary)

The Dealer typically installs the External Splice Box before delivering the riser. If it is not installed, or if an internal splice box is used, install it now following the directions supplied with the splice box.

External splice box



Internal splice box

Step 3: Set the Pump Basin in the Hole

Step 3a: Dig the hole for the pump basin 4 inches (100 mm) deeper than the height of the basin, and place a 4-in. (100-mm) bed of compacted gravel in the bottom of the hole.

Step 3b: Place the pump basin in the hole and level the pump basin. If the same excavation is being used for the pump basin as the riser, make sure the top of the pump basin matches the level of all of the other riser lids. If the pump basin is in a separate excavation, set and level the pump basin appropriate for the final grade.

Step 3c: Orient the grommet holes on the pump basin so as to minimize the number of bends in the electrical conduit between the control panel and the splice box. Partially backfill the hole to support the basin while you're working on it.

Step 3d: If you are going to set the pump basin in a concrete collar, set the basin on its gravel bed, mix a three-bag batch of concrete, and pour it around the bottom of the basin. The concrete should extend 6 inches (150 mm) on all sides of the basin to a depth of at least 6 inches. (150 mm).

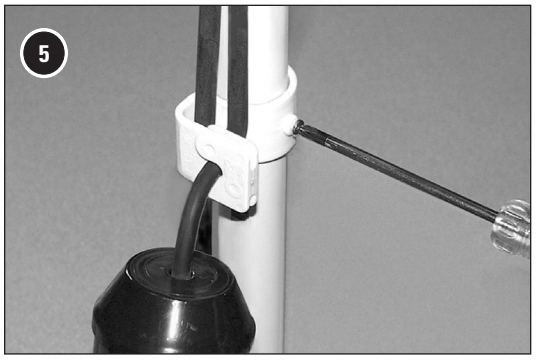
Step 4: Install the Filtrate Line

Step 4a: To mark the position of the inlet hole on the pump basin, extend a piece of pipe or a straightedge from the outlet of the RSV to the pump basin so that it slopes at least ¼ inch per foot (20 mm per meter, or a 2% slope). Mark the center of the inlet hole on the pump basin, and install a 2-in. (50 mm) grommet. Apply a bead of ADH 100 adhesive to the 2-in. (50 mm) grommet and install it in the hole. Lubricate the inside of the grommet with pipe lube.

Step 4b: Push the end of the 2-in. (50-mm) filtrate line through its grommet. It must extend far enough into the pump basin to allow attachment of an elbow, but not so far that it interferes with other components. Glue a downward-facing elbow to the end of the filtrate line inside the pump basin. Glue the other end of the line into the discharge coupling of the RSV tee.

Step 4c: Drill the appropriately sized hole for the line going to the dispersal area, and install a grommet.

Step 5: Set the Floats and Install the Float Assembly



Step 5a: To adjust the height of the float switches, loosen the screw on the float collar and slide the collar along the float tree. Do not try to change the tether length.

Step 5b: Set the high level float even with the invert of the inlet pipe. Set the "Pump On" float 2 inches (50 mm) below that. Set the "Pump Off" float at a level that will produce the desired dose volume for the drainfield. A 24-in. (600-mm) pump basin holds 1.88 gallons per inch of height (2.8 liters per centimeter). Make sure that the "Pump Off" float is not below the pump's minimum liquid level. Make sure that the floats do not interfere with other components in the basin.

Step 5c: Install the float assembly in the bracket inside the basin. Wrap the cords neatly and secure them to the splice box using the hook-and-loop strip provided.

Step 6: Install the Pump and Discharge Assembly

Step 6a: Assemble the pump and discharge assembly using Teflon paste or tape. Lower the pump into the flow inducer at the bottom of the basin. Insert the nipple of the discharge assembly through the grommeted hole for the line to the dispersal field.

NOTE: *Instructions for installing conduit and wiring in the External Splice Box can be found in the* External Splice Box Installation Instructions *(EIN-SBEX-1)* supplied with the splice box.*

Step 6b: Lay the pipe for the line to the dispersal area in the trench and connect it to the discharge nipple using external flex hose. Do not bend the flex hose more than fifteen degrees. If local regulations require it, install toning wire on this pipe before backfilling.

Step 6c: Make sure the pump basin's lid is securely screwed on before you leave the site.

* *These documents are included with the component. You can also download them from the online Document Library at www.orenco.com.*

Notes

AdvanTex® AX20 Treatment Systems

Installation Guide

Residential Applications

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AdvanTex Treatment System AXN Models meet the requirements of ANSI-NSF Standard 40 for Class I Systems.

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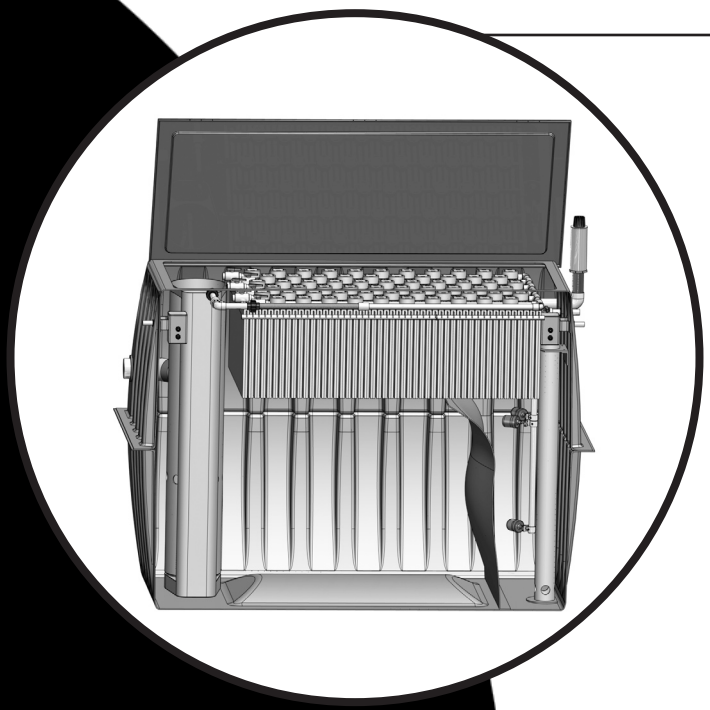
Installation Manual

AdvanTex® AX20-RT Treatment Systems

Residential Applications



An illustrated guide to installing an Orenco AdvanTex® AX20-RT Treatment System.

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1 Installation Manual: *AdvanTex® AX20-RT Treatment Units*

Before You Begin

As the installer of an onsite wastewater treatment system, you play a crucial role. Homeowners, neighbors, service providers, regulators, Dealers, manufacturers ... we all rely on your expertise and good work. At Orenco, we've worked hard to make your installation as easy and "hassle-free" as possible.

Property owners, neighbors, regulators, Dealers, manufacturers, and service providers all depend on your careful installation.

We're very proud of this wastewater treatment system. Like all our products, the AdvanTex® AX20-RT Treatment Unit has gone through extensive research, development, and field-testing. Then each component is built to written specifications and subjected to quality review before shipping. In addition, our RTN models meet the requirements of NSF/ANSI Standard 40 for Class I Systems. If this system or any of its components possesses flaws that would inhibit its proper functioning, please contact your authorized AdvanTex Dealer. The Dealer can also provide repair and replacement instructions and replacement components. If there is no authorized AdvanTex Dealer in your area, call Orenco Systems®, Inc. at 800-348-9843 or +1-541-459-4449.

Installation Manual: *AdvanTex® AX20-RT Treatment Units*

This manual covers installation of all models of our AdvanTex AX20-RT Treatment Units. In addition to this manual, a separate manual that contains installation, wiring, and operating instructions for Orenco control panels is packaged with the control panel. Please read all other control panel documentation, as well.

It's important that you read through this entire manual before beginning the installation. And make sure you have the correct equipment, materials, tools, and training to perform this installation. Please note that *you must perform the installation according to the current manual to keep the warranty in force*.

Once you become familiar with the installation process, you should be able to install an AdvanTex AX20-RT unit in less than half a day, not counting the time to install the tank and dispersal system.

Conditions for Using an AX20-RT to Repair an Existing System

Before you install an AX20-RT to repair or upgrade an existing septic system, be sure that the following conditions are met:

- The existing septic tank must be Orenco-approved and must meet all applicable regulatory requirements. (No pour-in-place tanks, no homemade tanks, etc.)
- The existing septic tank must be structurally sound.
- The existing septic tank must have at least 1000 gallons (3800 liters) capacity at the normal operating level (1000 gallons or 3800 liters available below the invert of the outlet).
- The existing septic tank must have an at-grade access with a securable and removable lid. If it doesn't, an at-grade access must be installed onto the septic tank and be made watertight.
- The existing septic tank must be tested for leakage to a height of at least 2 inches into the riser, and it must hold water for at least sixty minutes.
- An Orenco effluent filter (model FTS0444-36V, FTW0444-36V, or FT0822-14B) must be installed and accessible in the existing septic tank.
- The depth of burial of the existing septic tank must allow for a fall of at least ⅛ in. per foot (10 mm per meter or 1%) from the outlet of the septic tank to the inlet of the AX20-RT unit if the septic tank uses a gravity discharge. If sufficient fall cannot be met, a pumping system will need to be installed in the septic tank to move the filtered effluent to the AX20-RT unit. (Contact Orenco for assistance.)

Important Notes

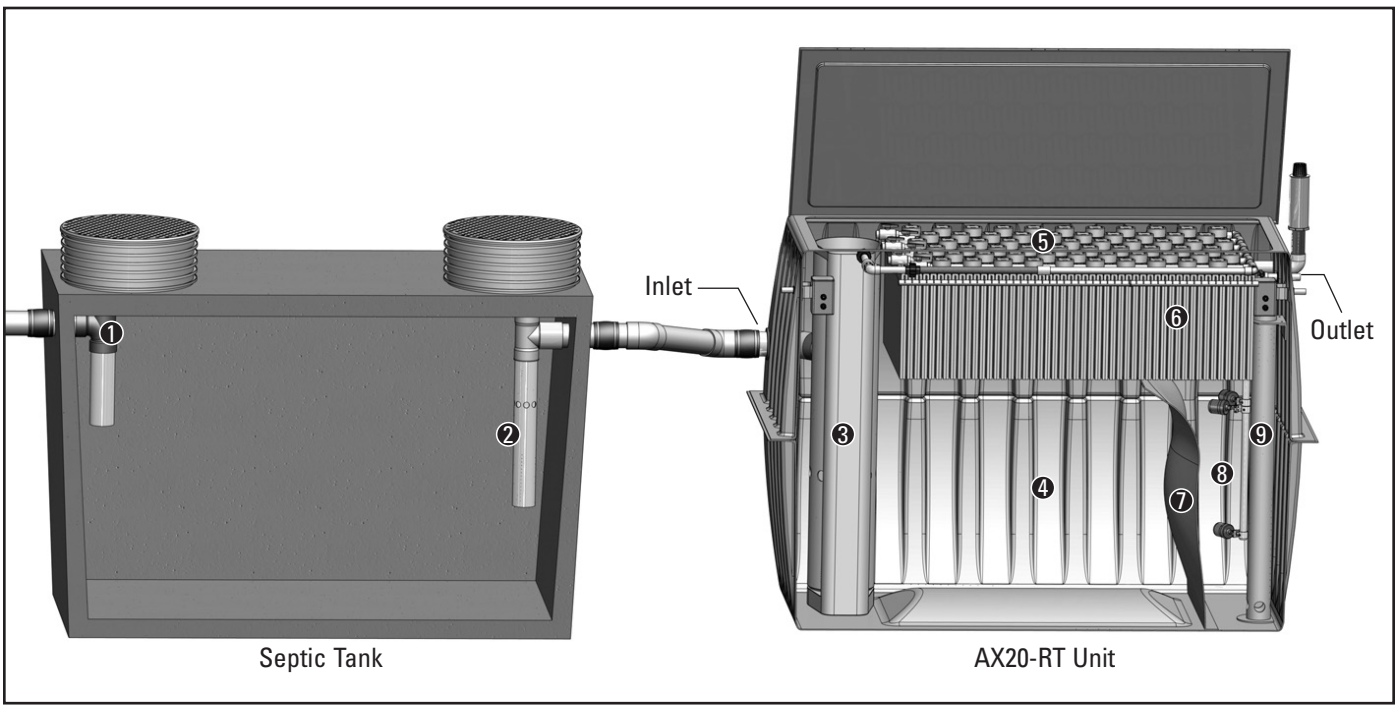
- *All tanks used with AX20-RT Treatment Units must be prequalified. Call your local Dealer for specifics.*
- *The backwash discharge from a salt-type water softener MUST NOT be plumbed into an AX20-RT Treatment Unit or the preceding septic tank. Failure to follow this instruction, or any other in this manual, will void the system's warranty. Contact your AdvanTex Dealer if you have any questions about any household plumbing arrangements that may interfere with the functioning of the system.*
- *All pipe diameters given are U.S. nominal IPS pipe sizes. If you are using metric pipe, you may need adapters to connect to the U.S. fittings supplied.*
- *If you are not a trained AdvanTex Installer, contact your local AdvanTex Dealer or Orenco for training before installing this system.*

Installation Manual: *AdvanTex® AX20-RT Treatment Units*

Overview

The AdvanTex® AX20-RT Treatment System has 10 main functional areas and components:

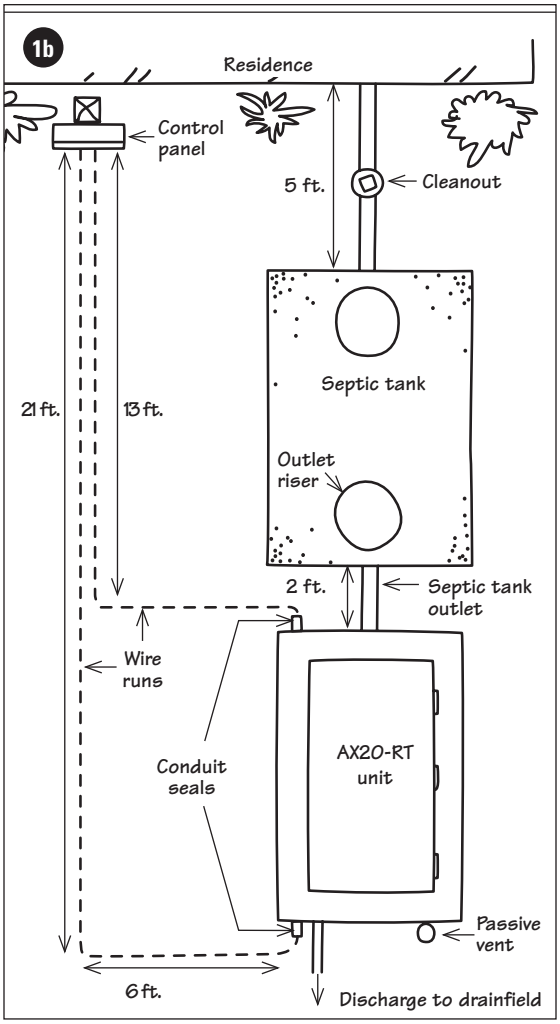
1. Septic Tank Inlet Tee
2. Biotube® Effluent Filter
3. Biotube Pump Package
4. Recirculating Treatment Tank (recirc side)
5. Manifold and Laterals
6. Textile Media
7. Tank Baffle
8. Recirculating Treatment Tank (discharge side)
9. Flow Inducer and Discharge Pump Assembly (pump discharge only)
10. Control Panel (not shown)



Concrete septic tank and AX20-RT (pump discharge model) shown

Raw sewage enters the septic tank through its inlet tee. In the septic tank, the raw sewage separates into three distinct zones: a scum layer, a sludge layer, and a clear layer. Effluent from the clear layer passes through a Biotube® effluent filter and is discharged by gravity to the recirculating treatment tank portion of the AX20-RT unit, which contains a Biotube Pump Package. The Biotube Pump Package pumps filtered effluent from the recirc side of the AX20-RT unit's recirculating treatment tank to the distribution manifold in the top of the unit. Effluent percolates down through the textile media and is divided — by means of a tank baffle — between the recirculating side and the discharge side of the AX20-RT recirculating treatment tank.

The operation of the pump on the recirc side of the tank baffle is controlled by a timer in the control panel, which allows the pump to dose the textile media for short periods (usually a half-minute or less), typically 72 times a day. This frequent "microdosing," which optimizes the treatment process, occurs 24 hours a day, to maintain the proper biological environment.



Sample sketch of a possible AX20-RT system layout

Step 1: Review or Sketch Site Plans

Before starting the installation, familiarize yourself with the site plans and specifics of your installation. If you are installing the AX20-RT unit more than 20 feet (6 meters) away from the septic tank, contact your Dealer or Orenco for assistance.

1a) Detailed Site Plans Provided:

If you are installing the AX20-RT according to a set of detailed plans, we recommend that you make sure that your plans accurately reflect conditions at the site. If there are differences between the physical site and the plans, we recommend you contact the Designer before scheduling the installation.

1b) No Site Plans Provided:

If you are installing the AX20-RT without detailed site plans, or with plans of limited detail, contact your local Dealer or Orenco for design assistance.

- *Determine and sketch the exact positions of the septic tank and AX20-RT unit on the site. Account for current and likely future landscape features in your sketch.*
- *Be sure to position the septic tank and unit to allow for a minimum ⅛ in. per foot (10 mm per meter or 1%) in the line from the outlet of the septic tank to the inlet of the AX20-RT unit, if the septic tank uses a gravity discharge.*
- *Determine and sketch the layout of your pipes, electrical conduits, and other critical buried elements. Provide measurements and distances on the sketch as accurately as possible.*
- *Sketch the placement of the control panel. (See Panel Installation, EIN-CP-GEN-1, for installation recommendations.)*

Step 2: Excavate and Set Septic Tank

This section covers excavating a hole for the septic tank and setting the septic tank. For information on excavating a hole for the AX20-RT unit, see Step 4.

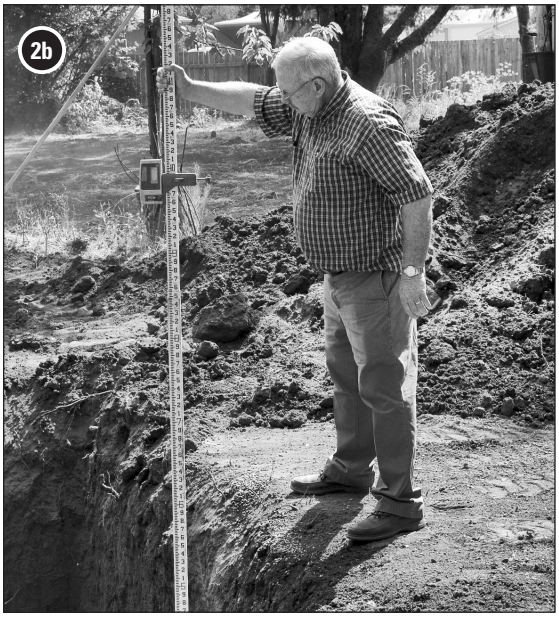
Consider the necessary elevations and grade requirements for the tank and the AX20-RT unit before excavating the hole for the septic tank. The septic tank must be set at the correct depth to allow for a minimum slope of ⅛ in. per foot (10 mm per meter or 1%) from the outlet of the septic tank to the inlet of AX20-RT if the septic tank uses a gravity discharge. Also, keep in mind that the AX20-RT needs to sit 2 inches (50 mm) above final grade.

Step 2a: Outline an excavation area (with chalk, paint, string, etc.) for the tank.

Step 2b: Excavate the hole for the septic tank following the tank manufacturer's recommendations. Remember that you need the correct depth for a consistent slope of at least ⅛ in. per foot (10 mm per meter or 1%) from the septic tank outlet to the inlet of the AX20-RT.

Step 2c: Make sure the bottom of the excavation is free of debris, rocks and other sharp objects. If the bottom of the excavation is uneven or rocky, lay a 4-in. (100-mm) bed of sand or pea gravel and compact the material to create an even, smooth surface.

Step 2d: Set the tank following the manufacturer's instructions. Follow the tank manufacturer's guidelines for watertight testing, antiflotation measures, and backfilling to the level of the top of the tank. Do not backfill past the top of the tank at this time.



Step 3: Install Risers and Water Test Septic Tank

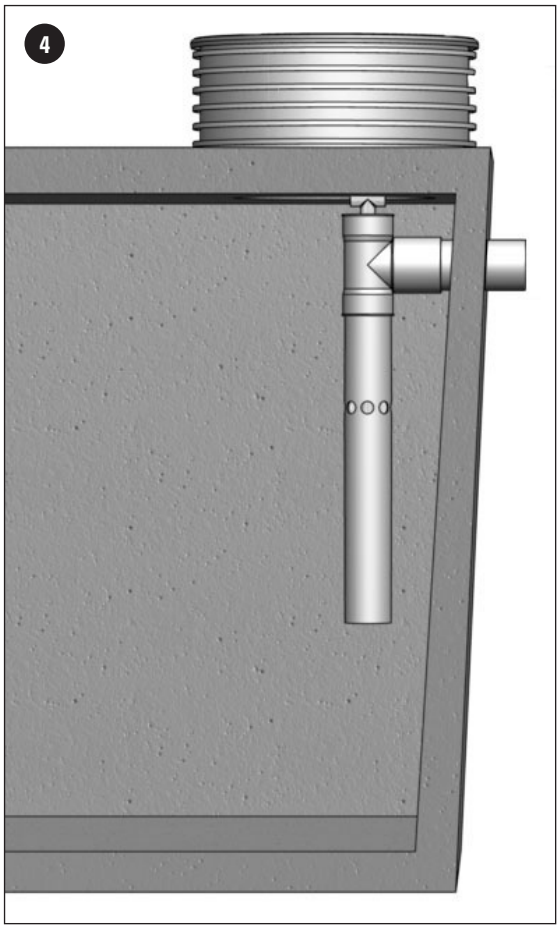
NOTE: *This section covers riser installations on septic tanks using gravity discharge. Contact Orenco for riser installations on septic tanks using pump discharge.*

Step 3a: Be sure you are installing the right size risers for your application and the size of the tank opening.

Step 3b: Wipe all of the areas to be bonded with a clean rag to ensure a clean, dry bonding surface.

Step 3c: To bond the riser to the riser tank adapter, you can use either ADH100 or methacrylate adhesive alone. However, because ADH100 does not provide a structural joint for approximately 24 hours, we recommend the use of both adhesives. If you use both, apply methacrylate adhesive to the outside surface of the riser tank adapter for a quick (usually an hour or less) structural joint.

Carefully slide the riser onto the adapter.



Orenco® effluent filter installed on the septic tank outlet

Step 3d: Carefully slide the riser onto the adapter. Correctly orient the riser before the adhesive starts to set.

Step 3e: Apply a bead of adhesive to the inside of the adapter and riser joint; then use a putty knife or similar tool to form a continuous fillet between the tank adapter and the inside of the riser.

Step 3f: After the adhesives have hardened, fill the tank with clean water to a level 2 in. (50 mm) above the adhesive joint in the riser, to test the watertightness of the tank and the riser joint. Do not allow the water level to rise more than 3 in. (76 mm) into the riser because structural damage to the tank may occur. The septic tank's inlet pipe and outlet pipe need to be turned up or plugged in order for the tank to be filled.

CAUTION: *Check the tank manufacturer's guidelines before water testing the tank. Some tank manufacturers require a partial or complete backfill before a tank is water tested.*

Step 3g: When the tank proves watertight, drain the excess water to the tank manufacturer's recommended level.

Step 4: Install Effluent Filter

Install the effluent filter after the tank has been water tested.

Step 4a: Verify the model of the effluent filter before you begin to install the filter. Orenco's FTS0444-36V, FTW0444-36V, and FT0822-14B filters are the only models allowed for use with the AX20-RT Treatment Unit.

Step 4b: Test-fit the effluent filter on the septic tank's outlet pipe without gluing. Make sure it fits plumb. Make sure the filter will fit as snug to the tank wall as possible while ensuring sufficient clearance for removing the filter cartridge.

Step 4c: Secure the filter to the outlet pipe. Two attachment methods can be used:

- You can glue the filter onto the tank outlet pipe using appropriate primer and glue.
- You can use a stainless steel set screw to secure the filter.

Step 4d: For easier access when servicing, you can extend the cartridge handle with a longer length of ¾-in. nominal (20-mm DN) Schedule 40 PVC pipe.

Step 5: Excavate and Set AX20-RT Unit

Before installing the AX20-RT, consider the depth of the septic tank and the height of the septic tank outlet. Remember that there must be a minimum ⅛ in. per foot slope (10 mm per meter or 1%) from the outlet of the septic tank to the inlet of the AX20-RT, if the septic tank uses a gravity discharge. Also, remember that the AX20-RT lid needs to sit 2 in. (50 mm) above finished grade, to allow for settling and drainage. Take into account any planned landscaping that might affect the finished grade of the system.

Step 5a: Outline an excavation area (with chalk, paint, string, etc.) for the AX20-RT. The excavation needs to extend 18-24 inches (457-610 mm) beyond all four sides of the unit.

Step 5b: Excavate the hole for the unit. The AX20-RT unit height is 72 in. (1830 mm). Make sure that the unit will be set deep enough to facilitate a minimum slope of ⅛ in. per foot (10 mm per meter or 1%) from the septic tank if the septic tank uses a gravity discharge. Also make sure that the lid will be 2 in. (50 mm) above final grade after the hole for the unit is excavated and after a compacted bed of aggregate or pea gravel — if necessary — is laid.

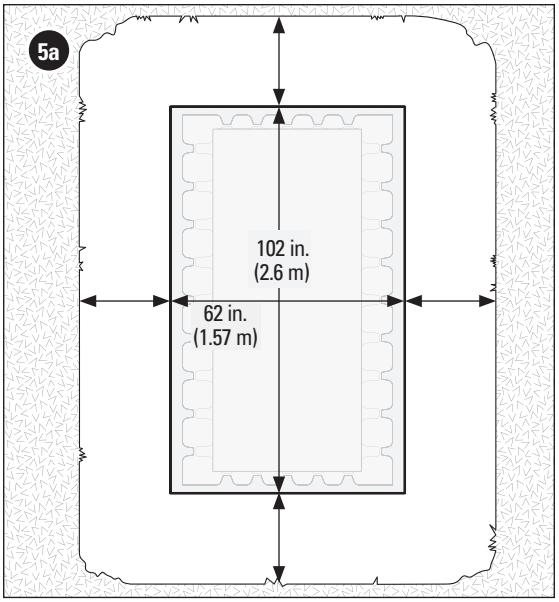
Step 5c: Make sure the bottom of the excavation is stable and free of debris, especially rocks and other sharp objects.

- If the base soil is unstable (peat, quicksand, muck, soft or highly expansive clay, etc.), overexcavate the site depth and then set a firm, 6-in. (152-mm) compacted base of ½-in.- to ¾-in.-minus (13- to 19-mm) aggregate or pea gravel. In extremely unstable soil, a concrete layer may be needed to stabilize the bottom of the excavation. If you have any doubt about the soil's ability to support the tank, consult a local civil or structural engineer.
- If the base soil is rocky or uneven, lay a 4-in. (100 mm) bed of sand or pea gravel less than ⅜ in. (10 mm) in diameter, and compact the material to create an even, smooth surface.

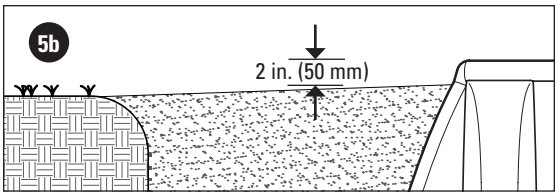
Step 5d: Use properly sized lifting equipment to attach a chain or cable to the two lifting brackets on the top of the AX20-RT unit. Carefully lift the unit and lower it into the excavation. When the unit is set and level in the correct position, remove the chain/cable.

WARNING: Do not allow workers to stand in or near the excavation while placing the unit!

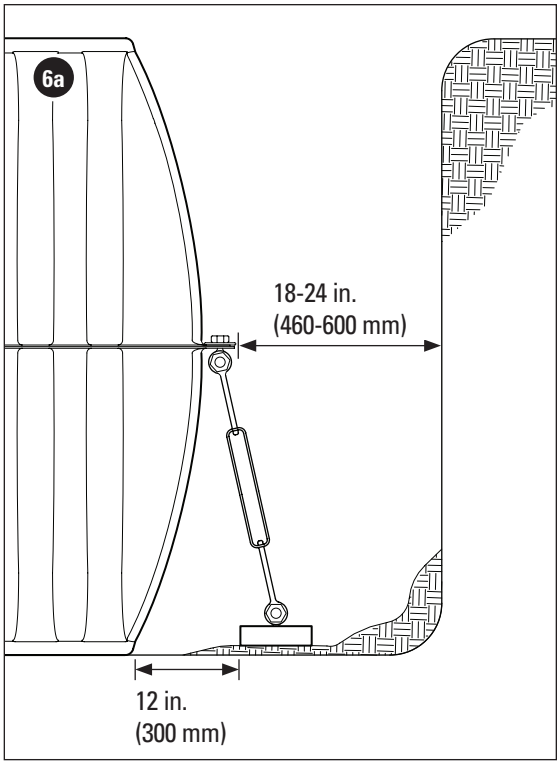
CAUTION: *Use a lifting device that will not damage the unit or the lid of the unit.*



Mark outline of the excavation area 18-24 in. (457-610 mm) beyond all four sides of the unit.



Excavate the hole so that the lid sits at 2 in. (50 mm) above final grade.



When using Orenco fiberglass deadmen, be sure to place them on a small lift of soil 12 in. (300 mm) from the bottom of the AX20-RT.

Step 6: Determine Antibuoyancy Needs

Because of the AX20-RT's shallow burial depth, you may need to install antibuoyancy deadmen on the unit. Deadmen are necessary when two specific conditions occur at the same time:

- Groundwater is shallower than 36 in. (0.9 m) below grade; and
- The AX20-RT is empty or it is being pumped empty

If these conditions can occur at the site, install Orenco fiberglass deadmen or your own concrete deadmen on the AX20-RT. If you are unsure whether or not your installation requires deadmen, consult the system designer or engineer.

Orenco's counterbuoyancy hardware kits will work with both Orenco fiberglass deadmen and concrete deadmen.

6a) Fiberglass Deadmen

1: Secure the fiberglass deadmen along the length of the unit, on both sides, with the antibuoyancy hardware. Then lower the unit into the excavation.

2: Build up a 3- to 4-in. (75- to 100-mm) lift of soil on each side of the unit for the deadmen to rest upon and place the deadmen at least 12 in. (300 mm) from the bottom of the unit, as shown in illustration 3b.

6b) Concrete Deadmen

1: Forms for concrete deadmen can be made from 12-in diameter × 4-ft long (300-mm × 1200-mm long) PVC half-pipe or chamber material; or simple forms 12 in. wide × 6 in. tall × 4 ft long (300-mm × 150-mm × 1200-mm) can be built from wood.

NOTE: *To save time, we recommend preparing concrete deadmen offsite before you install the unit.*

2: Fill two forms halfway with concrete, place two #4 reinforcing bars in each of the forms, and then finish filling the forms. When you are finished filling the forms, sink eyebolts from the antibuoyancy hardware kit into the concrete for attaching the deadmen later.

NOTE: *Allow the concrete to set completely before lifting or moving the deadmen.*

3: Use appropriate lifting gear to set the deadmen in place and secure them along the length of the unit, on both sides, with the antibuoyancy hardware kit.

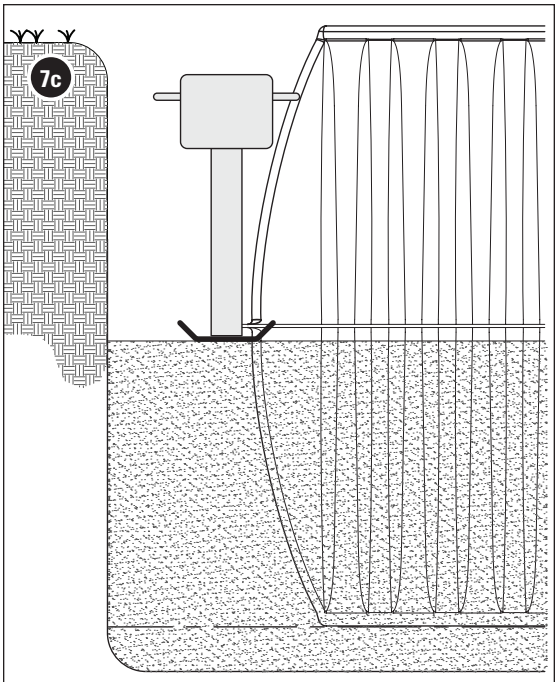
Step 7: Partially Backfill AX20-RT Excavation

WARNING: DO NOT backfill around the RT unit unless the lid is bolted down! For increased rigidity, keep the AX20-RT lid bolted down while backfilling and compacting.

Step 7a: Fill the AX20-RT unit with 16 in. (410 mm) of water for internal support. Be sure to fill all tank chambers.

Step 7b: Backfill around the unit with a 16-in. (410-mm) layer of material. Native material is acceptable if there are no large or sharp rocks that may damage the unit's walls. If native material is not usable, backfill with ½-in. aggregate or pea gravel. Do not backfill with sand. Use a mechanical compactor to thoroughly compact the fill, to minimize settlement and provide support for the unit's walls.

Step 7c: After completing the first layer of backfill, fill all of the tank chambers with water to just above the midseam flange. Add another 16-in. layer of backfill. Compact the backfill until it is 2-3 in. (50-75 mm) below the midseam flange.



ATTENTION:

Do not backfill around the unit unless the lid is bolted down!

Step 8: Test Watertightness of AX20-RT Unit

Step 8a: After backfilling the AX20-RT excavation to just below the midseam flange, make sure that the unit is filled with water to at least 1 in. (25 mm) above the midseam flange on both sides of the tank baffle.

Step 8b: Wait at least 15 minutes and then inspect the midseam of the unit for leaks. There should be no drop in liquid level and no visible leakage from the seam.

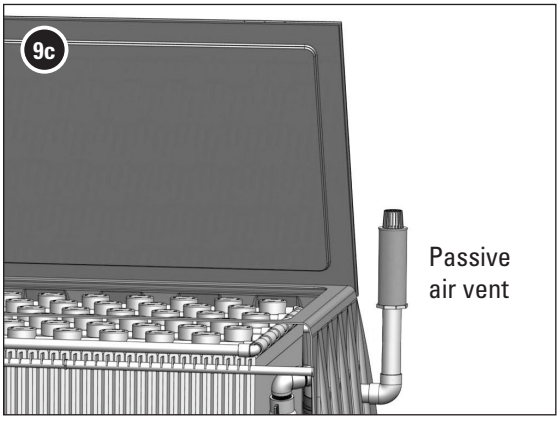
Step 9: Connect Transport Line and Passive Air Vent

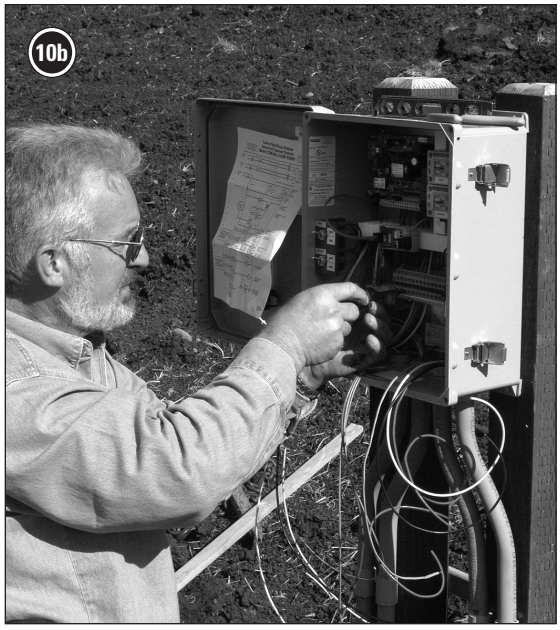
NOTE: *DO NOT use primer on ABS parts.*

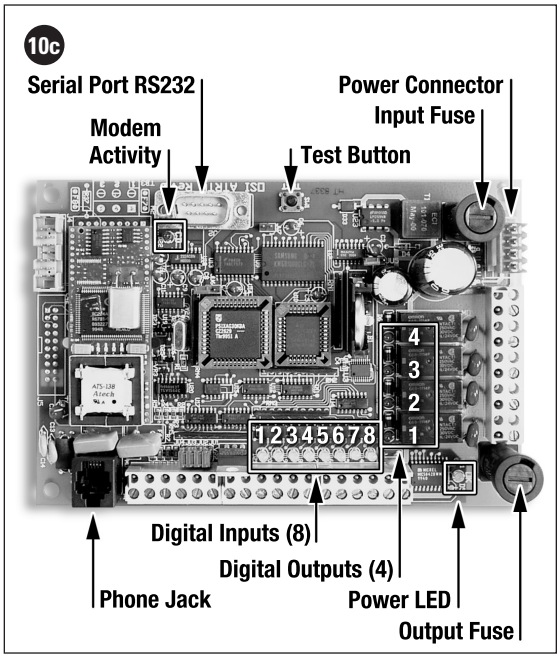
Step 9a: Dry fit the 4-in. (100-mm) transport line and any fittings between the outlet of the septic tank and the inlet of the AX20-RT unit. Make sure that you maintain a minimum of ⅛ in. per foot (10 mm per meter or 1%) slope from the septic tank if the septic tank uses gravity discharge.

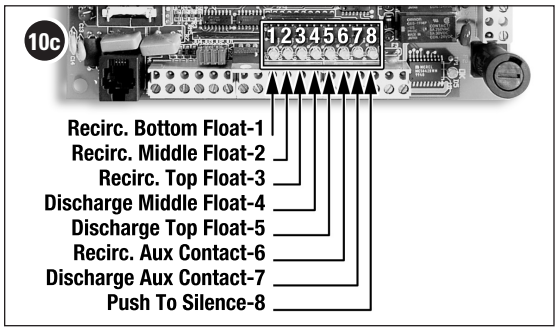
Step 9b: Glue all of the transport line pieces in place.

Step 9c: Use 2-in (50 mm) PVC pipe to plumb the passive air vent to the 2-in. (50 mm) vent fitting that protrudes from the outlet side of the AX20-RT unit. Be sure the vent line is sloped to drain towards the unit and that the passive air vent is within 20 ft (6 m) of the unit. After installation, the top of the passive air vent should be a minimum of 3 in. (75 mm) above final grade.









IMPORTANT: *In all cases, the line between the passive air vent and the unit must be sloped back ¼ in. per foot (20 mm per meter) toward the unit. To prevent accumulation of water, do not allow any "bellies" or low points in the vent piping. Keep the 2-in. vent piping less than 20 ft (6 m) in total length.*

Step 9d: We recommend installing the passive air vent near a wall or in a similar location where it is less likely to be damaged by a lawn mower or accidental kicking, etc. You can easily hide the air vent behind shrubbery or other landscaping and paint it if another color is desired.

Step 10: Install and Test Control Panel

Install Control Panel:

For complete control panel installation instructions, see the installation manual for the electrical control panel that comes with your system. Instructions specific to your control panel ship inside of the control panel.*

Step 10a: Make sure the items supplied conform to state and local regulations.

Step 10b: A qualified and licensed electrician should install and service the panel and ancillary wiring in compliance with the National Electrical Code, as well as state and local codes. (Wiring diagrams can be found in the installation manual* that comes with the panel.) Wiring will include the following items:

a) *Incoming power to the panel. One or more circuits may be required, depending upon the number of pumps and local electrical codes.*
b) *Incoming phone line to the panel (for VeriComm® control panels)*
c) *Wiring from the control panel to the pump and floats*
d) *Wiring to a discharge pump and floats (if applicable)*

NOTE: *We do <u>not</u> recommend installing a control panel against the wall of a bedroom, living room, or other living space because it makes a periodic thump during operation. If it must be placed near the house, mount it on 4 × 4 (100 × 100 mm) pressure-treated post(s) next to the wall.*

Test Control Panel:

VeriComm® (VCOM) telemetry-enabled panels are used for remote monitoring and control of AX20-RT pumping operations.

* *If the installation instructions are missing from the control panel, find the product model code, located on a sticker inside the panel door. Then call your local Dealer or log in to our online Document Library at www.orenco.com and download a copy of the installation instructions (Category "Instructions, Electrical"). You can also call Orenco for a replacement.*

Step 10: Install and Test Control Panel (cont.)

Fault conditions are automatically reported to the VeriComm Monitoring System, making the system virtually invisible to the homeowner. However, if fault conditions are not responded to, or if the system cannot communicate with the VeriComm Monitoring System, then local alarms may be activated.

Perform the following procedures to verify proper installation of the VeriComm panel.

NOTE: *For more detailed procedures specific to each panel model, refer to the documentation that comes with the panel.**

Step 10c: Familiarize yourself with the components of the telemetry control board. Step 10d: Make sure the panel has been completely and correctly installed, and verify that the circuit breakers are in the "On" position. Also check the controller status. The power LED, located on the control board, will be:

- *Blinking, which indicates the controller is operating normally, or*
- *Off (when power is applied), which indicates a possible problem with*
  - *~ the input fuse on the PC board;*
  - *~ the main fuse located inside the panel;*
  - *~ the controls circuit breaker located inside the panel; or*
  - *~ the incoming line voltage.*

Step 10e: To enable Test Mode, hold the "Push-To-Silence" button on the front of the panel until the audible alarm sounds (approximately 15 seconds).

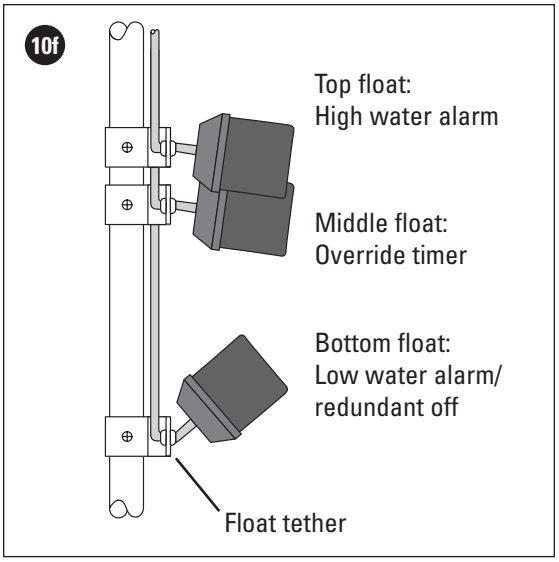
- *The appropriate digital input should be illuminated when the button is held in.*
- *When the audible alarm sounds to indicate that the panel is in Test Mode, release the button.*

While in Test Mode, the panel will operate in the following manner:

- *The call-in function is disabled;*
- *Local audible and visual alarms are activated as alarm conditions occur;*
- *System Data Logs are suspended; and*
- *Timer cycles are shortened.*

Step 10f: Familiarize yourself with the floats on the system.

Step 10g: Verify that the pump is submerged in water before continuing. If the bottom float drops, the alarm should sound. Press down the spring-loaded "AUTO/OFF/MAN" switch located inside the panel. The pump should immediately activate. For verification, the appropriate digital input should illuminate, indicating that the auxiliary contact is on.



VeriComm® Recirculating Float Assembly shown

Measure voltage

Measure amperage

Step 10: Install and Test Control Panel (cont.)

Measure the voltage and amperage of the pump.

a) *Measure the voltage at the pump terminals in the panel. Measuring the voltage with the pump off will confirm that the correct voltage is connected. Then activate the pump by toggling the AUTO/OFF/MAN switch to MAN, or using a PDA or laptop with the Bluetooth Device, and measure the voltage while the pump is running. The maximum recommended voltage drop is 3%. A low voltage condition may indicate that the site wiring is improperly sized.*

b) *Using a loop ammeter, place the ammeter clamp around the loop of wire located above the pump circuit breaker and read the amperage while the pump is running and connected to the discharge assembly with the valves at the end of the laterals closed. The amperage should be within the specifications of the pump.*

Step 10h: Refer to the control panel documentation to test the floats that activate/deactivate the pump. To perform the float test, make sure there is enough liquid in the tank. If there isn't enough liquid in the tank, turn the pump circuit breaker off.

NOTE: *If phone service to the panel is active, complete step 10i. If not, proceed to step 10j. However, phone service should be activated before system start-up.*

Step 10i: Press and release the "Push-To-Silence" button 15 times within a one-minute period. This instructs the panel to call the VeriComm Monitoring System.

- *A red LED ("Modem Activity" component) should illuminate, indicating that the controller has established communication with the host. (This may take a few minutes.)*
- *Once the communication session has ended, the modem will automatically disconnect.*
- *If the LED does not illuminate within the specified time, verify that the phone line has a dial tone. This can be done by hooking up a phone to the line that is going into the panel.*

Step 10j: The panel will automatically disable Test Mode and return to normal operation after 30 minutes. To disable Test Mode manually, hold the "Push-To-Silence" button on the front of the panel until the audible alarm sounds (approximately 15 seconds). The appropriate digital input should be illuminated when the "Push-To-Silence" button is held in. When the audible alarm sounds to indicate that the panel is no longer in Test Mode, release the button.

Step 11: Test System Function

Once power is connected to the control panel, follow these steps to prepare the system for operation.

IMPORTANT: *Before using a generator to operate a pump, contact your Dealer or Orenco to make sure the generator can supply sufficient starting amperage.*

NOTE: *When testing pumps, always make sure there is enough water in the unit to safely run the pumps.*

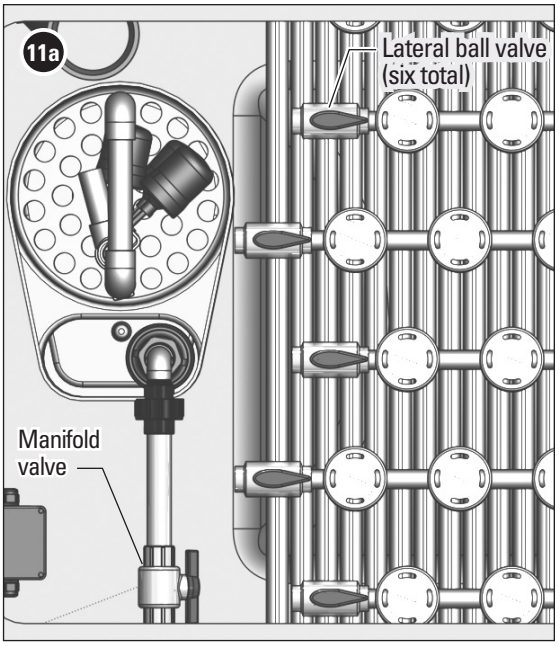
Step 11a: Open the manifold valve and the lateral ball valves and then toggle the "AUTO/OFF/MAN" switch for the recirc pump to "MAN" for 5-10 seconds to flush any debris out of the manifold and laterals. Close the lateral ball valves. With the recirc pump still in "MAN," remove several orifice shields and measure squirt height. Squirt height should measure between 3-5 ft (0.9-1.5 m). Windy conditions will cause a lower squirt height. When finished, return the "AUTO/OFF/MAN" switch to "AUTO."

NOTE: *If the desired squirt height is not achieved or the unit does not pressurize, check for debris, breaks, or closed valves. Also verify that the pump is receiving sufficient power. If the unit still does not pressurize correctly, contact your Dealer or Orenco for technical assistance.*

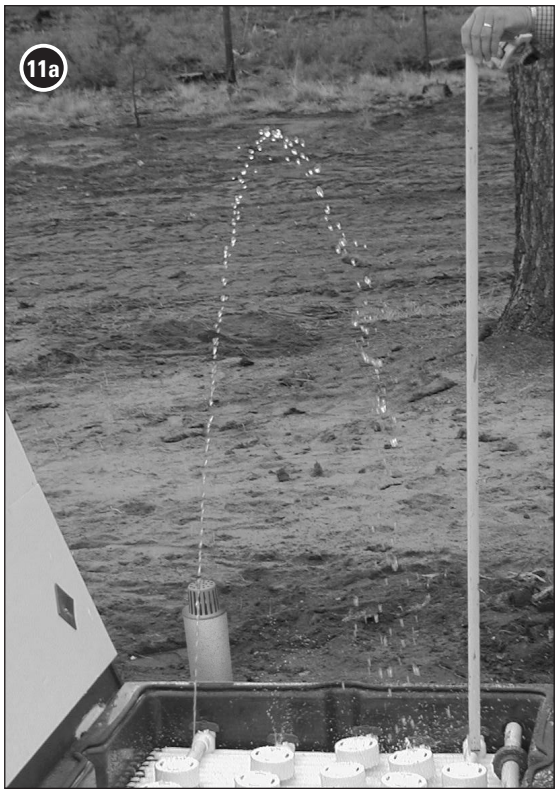
Step 11b: Place the control panel in Test Mode. Check the function of the recirc pump floats by lifting the low-level, mid-level, and high-level float in turn and verifying that the pump cycles on and off for each. If the unit is not equipped with a discharge pump, take the control panel out of Test Mode at this time.

Step 11c: If the unit has a discharge pump, make sure there is enough water on the discharge side of the tank baffle for the pump to run. Make sure the control panel is in Test Mode. Check the function of the discharge pump floats by lifting the low-level, mid-level, and high-level float in turn and verifying that the pump cycles on and off for each. When you are finished, take the control panel out of Test Mode.

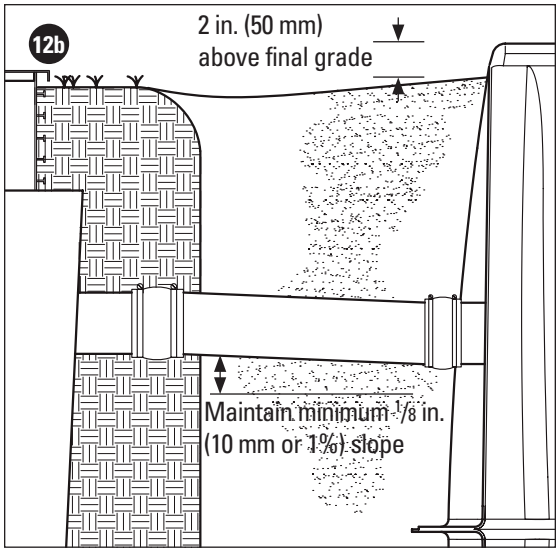
Step 11d: Close and bolt down the AX20-RT unit lid when you are finished.



Open the manifold valve and lateral valves.



Measure squirt height.



Backfill the AX20-RT in 12-in. (300 mm) lifts

Step 12: Complete Final Backfilling

IMPORTANT: *When backfilling, be careful not to alter the slope of pipes. Brace the pipes or place the pipes on a compacted bed and carefully fill around them.*

NOTE: *Before backfilling, make sure the AX20-RT unit lid and all riser lids are bolted down.*

Step 12a: Backfill the septic tank excavation if it has not yet been done. Follow the tank manufacturer's guidelines for backfilling.

Step12b: Backfill and compact around the AX20-RT unit in maximum 12-in. (305-mm) lifts. Native material is acceptable if there are no large or sharp rocks that may damage the unit's walls. If native material is not usable, backfill with ½-in. aggregate or pea gravel. For installations in non-cohesive soils* with high seasonal water tables, use ¾-in. crushed rock as the backfill material. The top of the AX20-RT lid should sit 2 in. (50 mm) above final grade.

IMPORTANT: *After backfilling, call the system's Service Provider to arrange for the official System Start-up.*

* *As described in OSHA Standards (29 CFR, Part 1926, Subpart P, Appendix A), noncohesive soils or granular soils include gravel, sand, or silt with little or no clay content. Granular soil cannot be molded when moist and crumbles easily when dry. Cohesive soils include clayey silt, sandy clay, silty clay, clay, and organic clay. Cohesive soil does not crumble, can be excavated with vertical sideslopes, is hard to break up when dry, and when moist, can be rolled into threads without crumbling. For example, if at least a 2-in. (51-mm) length of 1/8-in. (3-mm) thread can be held on one end without tearing, the soil is cohesive.*

AdvanTex® AX20-RT Treatment Systems

Installation Manual

Residential Applications

Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

800-348-9843
541-459-4449
www.orenco.com
www.vericomm.net

AdvanTex Treatment System RTN Models meet the requirements of NSF/ANSI Standard 40 for Class I Systems.

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NIM-ATX-AXRT-1
Rev. 1.2, © 11/10
Orenco Systems®, Inc.

Part 1: Start-Up and Routine Maintenance of AdvanTex® Residential Wastewater Treatment Systems

O&M MANUAL

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800-348-9843
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Introduction

As an authorized AdvanTex Service Provider, you play a crucial role in Orenco's AdvanTex Program.

Orenco has always advocated regular, professional servicing of all onsite systems ... not just during the warranty period but for the life of the system. Regular servicing optimizes the treatment process and protects the property owner's investment. It also ensures that onsite systems protect public health, protect the environment, and are viewed as a reliable, sustainable technology.

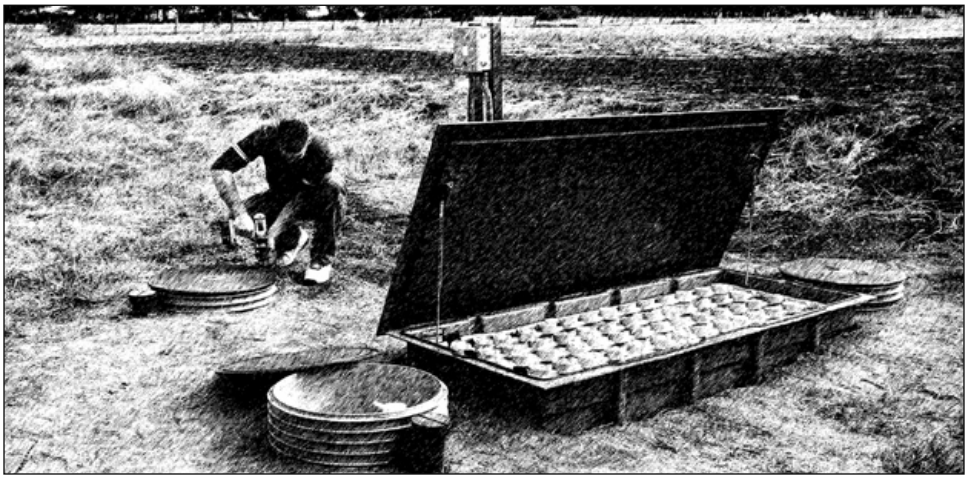
Orenco relies on you to perform the AdvanTex system start-up, do routine (scheduled) maintenance, and respond to calls for unscheduled maintenance (alarm calls). We also rely on you to keep in contact with the homeowners or property owners, review the *Homeowner's Manual* with them, advise them on preventive maintenance, and work to keep the system under a continuous service contract. Equally important, we rely on you to keep good service records on the system, creating a "history" of its performance.

To make your job easier, Orenco has created one of the most service-friendly and trouble-free onsite systems on the market. Then we paired that system with a remote telemetry control panel, to allow you to "view" the system right from your computer. And we've provided a Web-based business tool — advantexservice.com — to help you file and retrieve system data automatically, schedule service events, and manage service technicians.

Finally, we've provided classroom and field training, as well as support materials, like this O&M Manual. Please read this manual thoroughly, for up-to-date information on the best practices for system start-up and routine maintenance. You can find information about troubleshooting in Part 2 of our O&M Manual: *Advanced Service Tips and Troubleshooting Guide*.

We're very proud of our AdvanTex Treatment System. Like all our products, it has gone through extensive research, development, and field-testing. Then each component is built to written specifications and subjected to quality review, before shipping. In addition, our AXN models meet the requirements of NSF-ANSI Standard 40 for Class I Systems. If any component of this system does not meet your expectations, please call your authorized AdvanTex Dealer.

Thank you, in advance, for your knowledge, your conscientiousness, and your good work.



AdvanTex® O&M MANUAL

PART 1: START-UP AND ROUTINE MAINTENANCE

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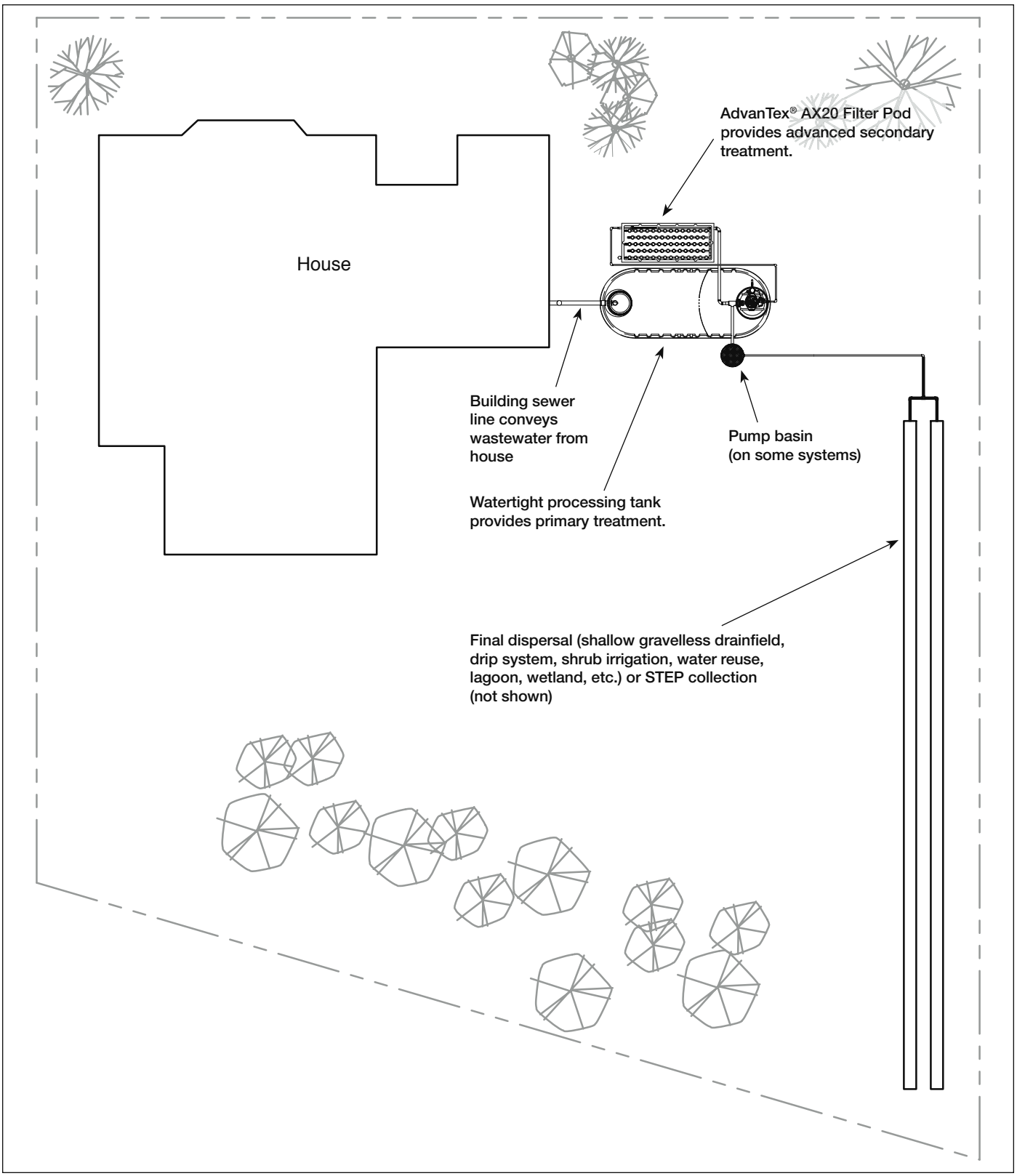
Typical Site Plan for an AdvanTex Treatment System



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How the AdvanTex Treatment System Works

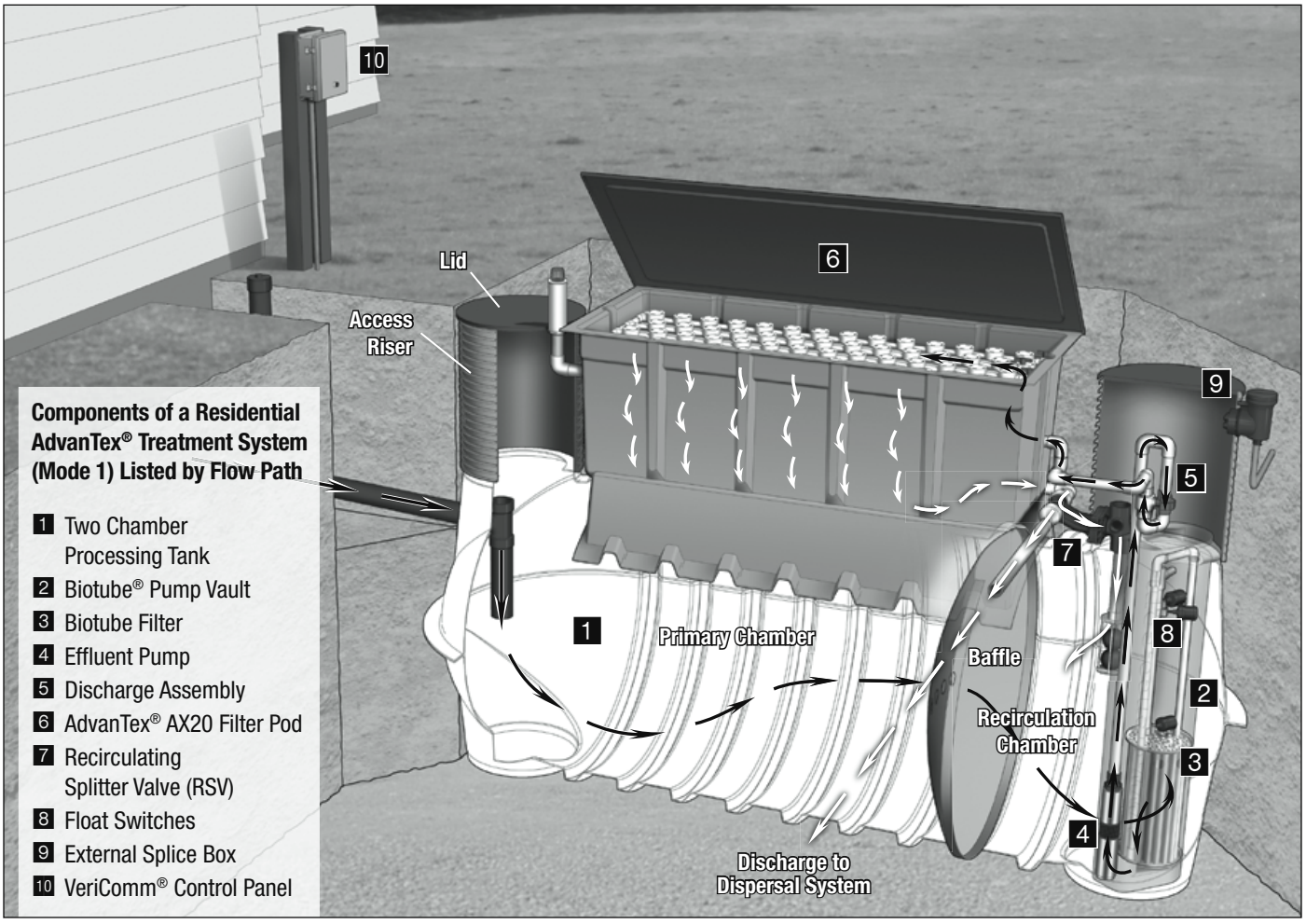
The AdvanTex Treatment System consists of a watertight processing tank and the AX20 textile filter pod. Wastewater from the home flows to the tank, where natural biological and physical processes provide primary treatment. In the primary chamber of the tank, the wastewater separates into three layers: a floating scum layer, a bottom sludge layer, and a relatively clear layer of liquid effluent in the middle.

From the secondary chamber, a pump draws liquid effluent through the Biotube® filter and sends it to the AX20 pod. There, the effluent is sprayed over hanging sheets of porous synthetic textile media. Microorganisms live in this moist, oxygen-rich (aerobic) environment. As effluent trickles over and through the sheets, the microorganisms remove impurities from it.

Effluent recirculates between the tank and the AX20 pod. In Mode 1, the most common configuration, the effluent recirculates to the second compartment of the tank. In Mode 3, effluent recirculates to the first compartment. This mode is used where maximum removal of nitrogen from the effluent is required.

After recirculating several times, the effluent is discharged, either directly from the processing tank or after first being collected in a pump basin. Depending on the design for a particular site, the treated effluent may be discharged to a drainfield, an underground drip irrigation system, a constructed wetland, an effluent sewer (STEP) system, or a reuse system. The system may include equipment for ultraviolet (UV) disinfection before ultimate dispersal of the effluent.

Properly sited, installed, and operated, a Residential AdvanTex Treatment System can treat wastewater to 10 mg/L BOD and 10 mg/L TSS. This level of treatment is better than what municipal wastewater plants provide. The system can also be configured to reduce nitrogen levels as required locally. When effluent treated in this way is dispersed to the soil, natural processes purify it further, and it eventually returns to the underlying water table, where it can be used again.



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Equipment List

Routine maintenance and troubleshooting requires a variety of tools, equipment, and spare parts. We recommend that an Authorized AdvanTex Service Provider have the following items at hand:

For Routine Inspection and Maintenance

- Cordless drill with 3/16-in. Allen wrench for lid bolts on risers and pod
- Extra lid bolts
- Sludge and scum measuring device (e.g., Nasco Sludge Judge® for sludge and Orenco SMUG for scum)
- Hook for raising floats to test them
- Biotube® filter cradle (OM-BIOTUBECRADLE)
- Bronze threaded check valve, for measuring pump flow rate in systems with drainbacks
- Backpack pressure washer
- Trash pump (and generator, if pump is electric) for removing solids from discharge basin
- AX20 manifold brush (AX-LATERALBRUSH)
- AX20 sheet cleaning wand (AX-CLEANINGWAND)
- Handheld computer (PDA) with Bluetooth® Kit or laptop with null modem cable (optional, to turn pump on and off at a distance from the panel)
- Electrical tester (voltage and amperage)
- Phone line tester (available from RadioShack®)
- Dissolved oxygen (DO) meter or colorimetric ampoules
- Sample bottles
- Turbidity meter
- pH meter or pH test strips
- Test strips for nitrate, ammonia, alkalinity
- Tape measure
- Calculator
- A copy of the *AX20 Installation Instructions* (NIM-ATX-AX-1), for reference

For Repairs

- Adhesive (ADH100, SS140, SS115)
- Control panel parts (circuit breakers, motor contactors, relays)
- Effluent pump(s)
- Extension cord
- Flashlight
- Hand tools (pliers, wrenches, screwdrivers, drill bits, hammer, shovel, hand saw, etc.)
- Heat gun or torch for bending conduit
- Inspection mirror (e.g., Prototek “Mirror on a Stick”)
- Plumber’s snake
- PVC cement and primer
- PVC fittings, 3/4 in. to 2 in. (20-50 mm)
- PVC pipe, 3/4 in. to 2 in. (20-50 mm)
- Spare parts for downstream components (e.g. drip headworks, UV)
- Waterproof wire nuts
- Wire stripping/crimping tool
- Float switches

For Troubleshooting

- Digital camera
- Watch or timer
- A copy of Part 2 of the AdvanTex O&M Manual: *Advanced Service Tips and Troubleshooting Guide* (AIM-OM-ATX-2)

For Personal Hygiene and Cleanup

- Bleach/water solution
- Eye protection
- Hand cleanser
- Paper towels
- Protective clothing
- Rags
- Rubber gloves

Start-Up Checklist

AX20 Start-Up Checklist

Service Provider _____

Technician | **Start-Up Date** | **Occupancy Date**

Primary Treatment

Process Tank.

- ☐ Proper inlet tee installed.

Process Tank Pumping Equipment.

- ☐ Discharge plumbing properly installed through watertight grommet, threaded connections tight, ball valve in open position.
- ☐ Float assembly mounted in Biotube® vault and properly set per AdvanTex Installation Guide. Float cords neatly wrapped around splice box and tied.
- ☐ Floats operate properly.
- ☐ Floats set properly (measuring from outside top of tank).
- ☐ Splice box mounted on access riser. Watertight connectors used.

Process Tank Pumping System.

- ☐ Pump operates in Manual.
- ☐ Pump operates in Automatic.
- ☐ Pump run amps: _____
- ☐ Pump rest volts: _____ run volts: _____

Secondary Treatment

Recirculating Splitter Valve Assembly.

- ☐ Verify proper RSV setting (measuring from top of cage to outside top of tank).

AdvanTex System.

- ☐ All pods installed level.
- ☐ All piping properly covered and compacted.

Ventilation System.

- ☐ Ventilation intake(s) properly located and installed.

AdvanTex Filter Operation.

- ☐ Squirt height verified.

Discharge Pump Basin/Tank.

- ☐ Basin/tank inspected for infiltration.
- ☐ Basin/tank is set level.

Discharge Basin/Tank Pumping Equipment.

- ☐ Pump and discharge plumbing are compatible (e.g. pressure rating).
- ☐ Discharge plumbing properly installed through watertight grommet, and ball valve is in open position.
- ☐ Floats operate properly.
- ☐ Floats set properly (measuring from outside top of tank).
- ☐ Splice box mounted in access riser. Watertight connectors used.

Discharge Basin/Tank Pumping System.

- ☐ Pump operates in Manual.
- ☐ Pump operates in Automatic.
- ☐ Pump run amps: _____
- ☐ Pump rest volts: _____ run volts: _____
- ☐ Dose volume verified.
- ☐ Flow rate verified (draw down test).

Other System Components

- ☐ Disinfection equipment installed properly.
- ☐ Dispersal equipment operating properly.

Controls

- ☐ Proper timer settings.
- ☐ Proper wire size used based on information provided by manufacturer.
- ☐ All electrical connections in panel secured.
- ☐ Panel wired per manufacturer's wiring diagram.
- ☐ Service provider name/number written on "For Service Call" label.
- ☐ Control panel functional test, as detailed in the *AdvanTex Installation Instructions*, has been followed.
- ☐ Dial tone verified.
- ☐ Control panel diagrams left in panel for future review.

Final/Safety Inspection

- ☐ All access riser hardware is in place. Lids are secured.
- ☐ All splice box lids are secured.
- ☐ Panel circuit breakers are in the "on" position, panel is set for automatic operation, and panel is latched (or locked if necessary).

Homeowner's Package

- ☐ Homeowner's Package reviewed with homeowner.

Comments

_____

_____

_____

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_____

_____

_____

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SCL-ATX-OM-1
Rev. 6.0, © 1/08

 • **AIM-OM-ATX-1, Rev. 1.1, 10/08**

Completing the Start-Up Checklist

System Start-Up Procedure

Your System Start-Up visit provides final confirmation that the system has been correctly installed and is ready to function properly. It also acquaints you, the service provider, with each individual system, so that you are familiar with any special components or requirements.

The *AX20 Start-Up Checklist* (SCL-ATX-OM-1), shown on the preceding page, will help you remember to complete all the steps needed to check the system's functions. While you don't need to return the *Start-Up Checklist* to Orenco, we recommend bringing a copy to the start-up and checking off the steps to make sure that you perform all of them.

As part of the start-up, you'll also download a computer-generated *Start-Up Summary Report* from advantexservice.com and fax it to the fax number on the bottom of the form. An automated system will add the report to the data file for that system on advantexservice.com. This will confirm that the system is ready for operation, so that Orenco and the AdvanTex Dealer can confidently warranty it and your service contract can begin.

Planning the Start-Up

When the installer calls to tell you that the system is ready for start-up, ask the following questions:

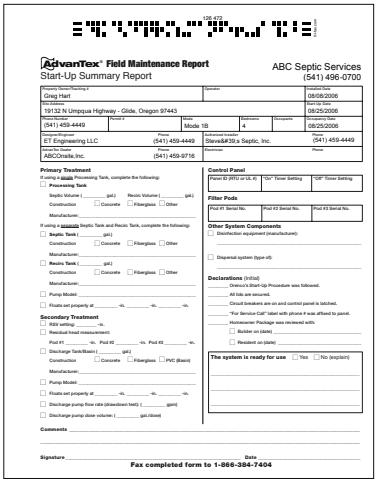
- Did the electrician connect the panel to the home's electrical service and turn the power on?
- Did the installer test the control panel to make sure it was functional?
- Is there phone service, or, at minimum, is the phone line physically connected to the panel?

If the installer answers "yes" to these questions, then the system is ready for start-up.

A typical start-up visit takes about an hour. Arrange to meet the system installer at the site so that he or she can answer any questions you may have about the installation. The installer should bring the site plan or as-built. If the system owners can be present too, this is a good opportunity for them to learn how the system functions. As part of the start-up, you will need to review the Homeowner Package with the homeowners or, if the house has not yet been sold, with a representative of the homebuilder. You can do this at the start-up visit, or arrange a meeting prior to the start-up.

Before Leaving the Office

Download the *Start-Up Summary Report* from www.advantexservice.com. The top of the form should be pre-filled with information about the site. If any information is missing, fill in. You will fill out the rest of the form at the site as you go through the start-up procedure.



AdvanTex® Field Maintenance Report
Start-Up Summary Report

ABC Septic Services
(541) 496-0700

Fax completed form to 1-866-384-7404

If the system does not have a discharge tank or basin and discharge pump, note that in the *Start-Up Summary Report*.

At the Site

Ask the system installer about the size, material, and manufacturer of each primary tank and discharge tank or basin, and record it on the *Start-Up Summary Report*. Also record the serial number of the AX20 pods.

 •

Completing the Start-Up Checklist (continued)

Primary Treatment

Open the risers of the tank and of any discharge or recirculation tanks or basins.

WARNING: *Do not enter tank. Entering a tank without proper confined space procedures and equipment can cause serious injury, asphyxiation, or drowning.*

☐ **Proper inlet tee installed.**

In the inlet riser of the primary processing tank, make sure that the inlet tee is present, firmly attached, and plumb.

☐ **Discharge plumbing properly installed.**

In the outlet riser, make sure that the discharge plumbing is properly installed through a watertight grommet. The threaded connections should be hand-tight, and the ball valve should be open. Look at the pump to make sure that it is the model specified on the plans, and record the model on the *Start-Up Summary Report*.

☐ **Float assembly mounted in Biotube® vault.**

☐ **Floats operate properly.**

Before you test the floats, open the control panel and place it in test mode by pressing and holding the red button on the front for 15 seconds. Inside the panel, the correct yellow digital input LED should light up. Release the button when the audible alarm chirps.

If you can't see the inside of the control panel while you raise and lower the float switches, you may need a helper. Pull the float tree out of the water. The floats will go down, the alarm will sound, and all the yellow LEDs should be off.

Raise the bottom float to stop the alarm. A yellow LED should light up.

Next, raise the middle float, if it is present. No alarm should sound, but another yellow LED should light up.

When you raise the top float, the alarm should sound again and the third yellow LED should light up.

☐ **Floats set properly.**

Replace the float tree in its bracket, making sure it's properly mounted. Neatly coil the float cords, and secure them to the splice box. Measure the float heights from the outside top of the tank and verify that the heights are correct according to the *AX20 Installation Guide*. Record them on the *Start-Up Summary Report*.

NOTE: *Orenco provides float and RSV settings for all tanks approved for use with AdvanTex Treatment Systems in your area. At start-up and during annual maintenance, you need only verify that the actual settings on the equipment match Orenco's recommendations. If you need to adjust the settings to solve a problem, see Appendix 2.*

☐ **Splice box mounted on access riser. Watertight connectors used.**

Inspect the splice box to make sure that it is securely mounted inside or outside the riser; that connections have been made using watertight wire nuts; and that there is no water in the splice box. We also recommend that you seal the conduit using conduit seals or any electrically approved sealant.

Completing the Start-Up Checklist (continued)

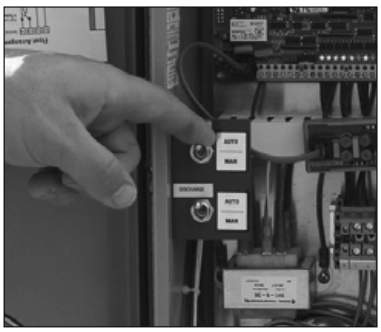
☐ **Pump operates in Manual.**

☐ **Pump operates in Automatic.**

☐ **Pump amps and volts checked.**

At the control panel, with the panel still in test mode, check the run amperage of the recirculation pump and discharge pump by placing the clamp of an ammeter around the wire to each pump's circuit breaker and reading the amperage while each pump is running. You can run the pump by holding the toggle switch on MAN. Amperage should be no more than the pump's maximum service factor amperage.

First for the recirculation pump and then for the discharge pump, measure the voltage with the pump off, by putting the probes of a voltmeter on each pump's terminals. Then measure the voltage with the pump running. The difference between running and rest voltage should be no more than 3 percent. That is 3.6 volts for a 120-volt system, or 7.2 volts for a 240-volt system.



Release the switch back to the AUTO position. Make sure the pump comes on as the timer cycles. Timer cycles are shortened to about 30 seconds in test mode.

Secondary Treatment

☐ **Verify proper RSV setting.**

Measure the distance from the outside top of the tank to the top of the Recirculating Splitter Valve (RSV) ball cage, and record it on the *Start-Up Summary Report*.

NOTE: *Improper RSV settings are a common installation error, so please check them carefully.*

☐ **All pods installed level.**

☐ **All piping properly covered and compacted.**

Check that each AX20 pod is installed level and that all piping is covered with compacted fill.

☐ **Ventilation intake(s) properly located and installed.**

☐ **Squirt height verified.**

Open each AX20 pod and make sure that the ball valves at the end of the laterals are closed. Remove an orifice cover and measure the squirt height. Record the squirt height on the *Start-Up Summary Report* as "Residual Head Measurement."

☐ **Discharge basin/tank inspected for infiltration.**

☐ **Discharge basin/tank set level.**

Inspect the discharge pump basin or tank to make sure that it is set level and there is no sign of water infiltration.

☐ **Pump and discharge plumbing are compatible.**

☐ **Discharge plumbing properly installed.**

Look at the pump to make sure that it is the model specified on the plans, and record the model on the *Start-Up Summary Report*. Verify that the discharge plumbing is installed as specified on the plans; that it is properly installed through a watertight grommet; and that the ball valve is open.

Completing the Start-Up Checklist (continued)

☐ **Discharge floats operate properly.**

☐ **Discharge floats set properly.**

Check the function and settings of the floats in the discharge basin/tank as described under Primary Treatment Components, and record the float heights on the *Start-Up Summary Report*, as before.

NOTE: *To ensure proper system operation, check to make sure that floats are Orenco "A" or "V" floats.*

☐ **Splice box mounted in discharge access riser. Watertight connectors used.**

Inspect the splice box in the discharge basin/tank to make sure that it is securely mounted inside or outside the riser; that connections have been made using watertight wire nuts; and that there is no water in the splice box. Use conduit seals or electrically approved sealant.

☐ **Discharge pump operates in Manual.**

☐ **Discharge pump operates in Automatic.**

☐ **Discharge pump amps and volts checked.**

Test the discharge pump and check running amps, running volts, and resting volts at the same time you check the recirc pump.

☐ **Flow rate verified.**

☐ **Dose volume verified.**

Determining the discharge pump's actual flow rate enables you to determine the dose volume (the volume of wastewater being treated in each dose) and to calculate timer settings.

Knowing the dose volume also enables you to determine the volume of wastewater being treated in a given period. To do this, multiply the dose volume by the number of doses.

To verify the flow rate, follow Steps 1 through 7, then verify the dose volume in Step 8.

Step 1. Determine the gallons per inch (gpi) or liters per centimeter (L/cm) volume of the dosing tank or basin. A 24-in. (600-mm) diameter basin holds 1.88 gpi (2.8 L/cm). A 30-in. (750-mm) diameter basin holds 2.96 gpi (4.4 L/cm). For tanks, consult the manufacturer's volume chart. For Orenco fiberglass tanks, use Fiberglass Tank Volume Charts, NCH-TNK-1.

Step 2. You'll be running the pump for one minute during the flow rate test, so check the liquid level inside the tank/basin to ensure that there's enough water above the pump's minimum liquid level (MLL), or the lowest float (whichever is higher), to complete the test. For example, in one minute, a pump operating at 10 gpm (37.8 L/min) will draw down approximately 5¼ in. (14 cm) of liquid in a 24-in. (600-mm) diameter basin, or

10 gallons ÷ 1.88 gpi = 5¼ in., or
37.8 liters ÷ 2.8 L/cm = 14 cm

So, to perform a flow rate test with the pump and basin in this example, you'd need at least 5¼ in. (14 cm) of water above the MLL or the bottom float (whichever is higher). If there is not enough liquid, add some.

Step 3. If your system isn't configured to drain back to the basin after each dose, skip to step 4. If your system is configured to drain back to the basin, you'll need to account for the drainback volume in your calculations. Or you can stop drainback during the test by temporarily installing a threaded check valve between the pump and the pump discharge assembly. This eliminates the need to measure drainback volume.

Step 4. To measure the flow rate, first measure the distance from the top of the tank or basin to the liquid level. Record this as H_1.

Step 5. Using a stopwatch, hold the discharge pump's toggle switch on MAN for exactly one minute. Then switch off the pump. If the system is configured to drain back into the tank or basin after a dose, wait until drainback is complete.

Completing the Start-Up Checklist (continued)

Step 6. Measure the new distance from the top of the tank or basin to the liquid level. Record this as H_2.

Step 7. To get the pump's flow rate, find the difference between H_2 and H_1. Multiply this number by the gpi (or L/cm) volume of the tank or basin. Add the drainback volume (DB), if applicable. Then divide by the pump run time in minutes (T). For this test, the pump run time in minutes should equal one minute.

$$\text{Pump flow rate (gpm)} = \frac{[(H2 - H1) \times \text{gpi}] + DB}{T}$$

or

$$\text{Pump flow rate (L/min)} = \frac{[(H2 - H1) \times \text{L/cm}] + DB}{T}$$

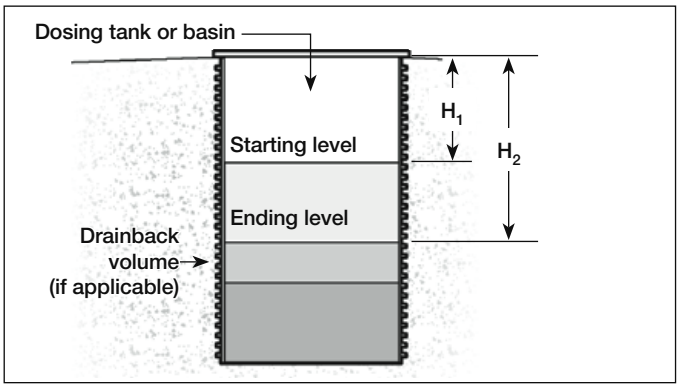
Important: At vericomm.net, enter the gpm value on the "Site Details" page as "Discharge Pump GPM." The VeriComm® panel will use it to automatically calculate and record the system's actual flow rates, which can be used for reports, troubleshooting, and determining timer settings.

Step 8. To verify the pump's dose volume, multiply the pump's flow rate (gpm or L/min) by the pump run time in minutes (T) — as determined by float settings or timer operation, depending on panel model — and subtract the drainback volume, if applicable.

Dose Volume (V) = (gpm × T) - DB,

or

Dose Volume (V) = (L/min × T) - DB



Other System Components

☐ **Disinfection equipment installed properly.**

☐ **Dispersal equipment operating properly.**

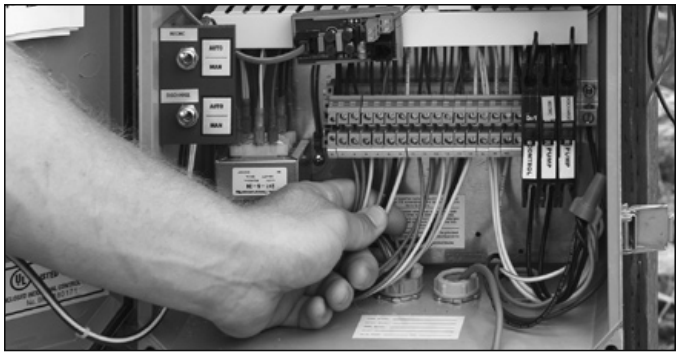
Verify that any disinfection and dispersal equipment specified on the plans is present, and follow the manufacturer's instructions to inspect it for proper functioning. Record the disinfection equipment manufacturer and the dispersal system type on the *Start-Up Summary Report*.

Control Panel

☐ **Proper timer settings.**

Open the control panel and, using a handheld or laptop computer, verify that the timer settings are appropriate for the installation. Record the Panel ID (RTU or UL number) and timer settings on the *Start-Up Summary Report*. Default timer settings are set for an occupancy of 3 people. This may also be adjusted at vericomm.net.

☐ **Proper wire size used based on information provided by manufacturer.**



For Orenco components, the panel installation instructions provide correct wire sizes.

☐ **All electrical connections in panel secured.**

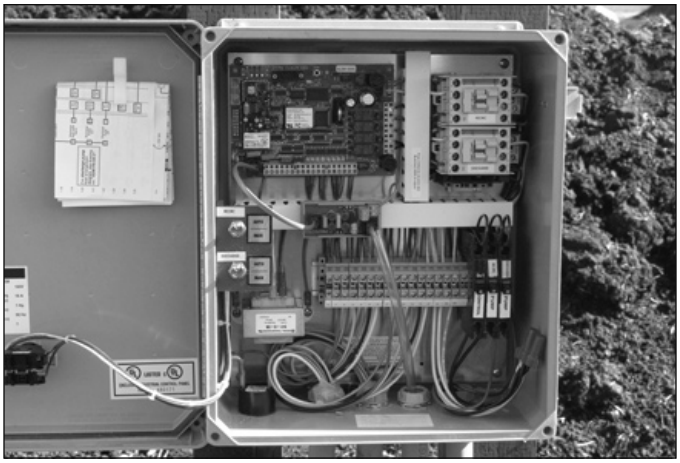
☐ **Panel wired per manufacturer's wiring diagram.**

Check the panel to make sure that it is wired according to the diagram clipped inside the panel's door. Gently tug on the wires to make sure they are secured in the terminals.

☐ **Service provider name/number written on "For Service Call" label.**

Write in your company's name and phone number, if it hasn't been done already.

Completing the Start-Up Checklist (continued)



☐ **Control panel functional test, as detailed in the *Residential AdvanTex Installation Instructions*, has been followed.**

The installer should have performed this test during installation. If not, perform it now.

Before performing the next step, return the panel from test mode to normal mode by holding down the alarm button on the front of the panel until the alarm chirps.

☐ **Dial tone verified.**

If phone service to the panel is not yet connected, you will be notified later when the service is connected and the panel automatically starts calling in.

If phone service *is* available to the panel, quickly press the alarm button on the front of the panel 15 times to force the panel to call in to the VeriComm® Web site. The Modem Activity light on the VCOM board should light up.

If the Modem Activity light does not light up, unplug the phone line from the phone jack on the panel and plug the phone line into a phone line tester, or a phone, to see if there is a dial tone. If there is no dial tone, come back and repeat the forced call-in test when phone service is activated to the panel. If there is a dial tone but the modem will not call in, call your AdvanTex Dealer for troubleshooting assistance.

☐ **Control panel diagrams left in panel for future review.**

Remember to leave the diagrams in the panel.

Final/Safety Inspection

☐ **All access riser hardware is in place. Lids are secured.**

☐ **All splice box lids are secured.**

Close and secure all pod, riser, external splice box, and basin lids.

WARNING: *If lid bolts are missing, replace them with spares. If you have no spare lid bolts, fasten the lid with a self-tapping screw, and immediately call your Dealer for replacement bolts. If the lid is unbolted or if the lid or riser are damaged, be sure to securely block access to the tank opening before leaving the site. Open tanks are hazardous, and children or adults who try to enter them may be seriously injured, asphyxiated or drowned.*

☐ **Panel circuit breakers are in the ON position, panel is set for automatic operation, and panel is latched (or locked if necessary).**

Make sure all circuit breakers are ON. If the panel is in test mode, it will automatically return to normal mode in 30 minutes. To manually return it to normal mode, hold the alarm button on the front of the panel down until the alarm chirps. Close and latch the panel, and lock it if necessary.

Make sure that the *Start-Up Summary Report* is completely filled out.

Homeowner's Package

☐ **Homeowner's Package reviewed with homeowner.**

Go through the *Homeowner's Package* with the homeowner, or with the builder's representative if the home has not yet been sold.

Back at the Office

Fax the completed *Start-Up Summary Report* to the number on the bottom.

Scheduled Field Maintenance Report

AdvanTex® Field Maintenance Report

Property Owner/Tracking #			Operator	
Site Address				Contact Phone
AX Site ID #	County ID #	Pod #	RTU #/UL #	Date of Last Inspection

Retrieve O&M Info

Daily flow_____

Recirc ratio _____

Timer settings:

Perform Field Sampling/Observations

NTU (15 ± NTUs)	pH (6-9)	DO (2-6)

Odor of Sample

Typical ☐ Musty ☐ Earthy ☐ Moldy

Non-typical ☐ Sulfide ☐ Cabbage ☐ Decay

Oily film in PVU ☐ Yes ☐ No

Foam in tank ☐ Yes ☐ No

Check Control Panel

Recirc Amps	Discharge Amps

Audible and visual alarms ☐ OK

Dial tone (telemetry only) ☐ Yes ☐ No

Inspect/Clean Pump System

	Inspect	Clean
Riser/Lid	☐	
Splice Box	☐	
Float Cords	☐	
Floats	☐	☐
Pump	☐	☐
Biotube® Filter	☐	☐
Biotube Pump Vault	☐	☐
Recirculating Splitter Valve	☐	☐

Measure Sludge/Scum

	Sludge		Scum	
1st Compartment	Current	Previous	Current	Previous
2nd Compartment	Current	Previous	Current	Previous

Inspect/Clean AdvanTex Filter

				Inspect	Clean
Odor:	☐ Normal	☐ Pungent	Laterals/Orifices	☐	☐
Biomat:	☐ Normal	☐ Excessive	Pod Bottom	☐	☐
Bridging/Ponding:	☐ None/Minor	☐ Excessive	Intake Vent	☐	☐

Inspect/Clean Discharge Pump System

	Inspect		Inspect	Clean
Riser/Lid	☐	Floats	☐	☐
Splice Box	☐	Pump	☐	☐
Float cords	☐			

Inspect/Service Other System Components

	Inspect	Clean		Inspect	Clean
Disinfection Equipment	☐	☐	Dispersal Laterals/Orifices	☐	☐

Observations _____

Additional Services Rendered

☐ Cleaned textile sheets? ☐ Replaced UV items?

☐ Replaced/Used other items?

Parts Used: W = Warranty, B = Billable (✓ appropriate selection)

W	B	Item Number	Description

Final/Safety Inspection

☐ RSV reinstalled ☐ Lids bolted on

☐ Manifold reconnected; flush valves closed ☐ Control panel reactivated

Summary/Recommendations

☐ System performing; no further action needed ☐ Tank needs pumping

☐ Call for service ☐ Other? _____

Comments _____

_____

Signature _____ **Date** _____

Fax completed form to 1-866-384-7404

Performing Scheduled Field Maintenance

Residential AdvanTex Treatment Systems require periodic servicing. AX20 systems need a six-month visit, a one-year visit, and annual visits* thereafter. AX20N systems require four visits during the first two years and annual visits* thereafter. Failure to provide required maintenance will void the AdvanTex Treatment System warranty and may place the system out of compliance with local regulations.

Homeowner Communication

Whenever possible, contact the residents when it's time for a service visit, especially if the residents are new to the home. The service visit is an opportunity to talk with them about proper use of the system, so try to schedule the visit when someone will be there.

Retrieve O&M Info

Download the *Field Maintenance Report* form for your site from www.advantexservice.com. The top of the form should be pre-filled with information about the system.

Perform Field Sampling/Observations

When you arrive at the site, remove the lids from the risers and take your sample before doing anything else, so that the sample won't be contaminated by material that you stir up while working. To sample effluent, remove the Recirculating Splitter Valve (RSV) from its quick-release holster and set it aside. There will be enough of a trickle through the RSV plumbing to collect a sample without waiting for the pump to cycle.

IMPORTANT: *To avoid contamination, do not run the pump manually or in test mode to obtain this sample.*

Wash down, brush, or wipe the RSV inlet before taking the sample so there will be no contamination from dislodged solids.

Leave the RSV disconnected for the rest of the service call so that any debris you stir up does not make its way to the drainfield.

☐ **Clarity of sample**

Assess the clarity of the sample by using a portable turbidity meter.

**Servicing intervals may vary according to local regulations.*

WARNING: *Follow the precautions below when performing field maintenance on AdvanTex Systems.*

- *Do not enter the tank. Entering a tank without proper confined space procedures and equipment can cause serious injury or death.*
- *Use proper personal protection equipment, such as rubber gloves and eye protection, as well as protective clothing, to cover parts of the body that will be exposed to wastewater or effluent.*
- *When working on components that contact sewage or effluent, lay them on a plastic sheet or place them in a trash can, not on the lawn. Several tools that reduce the mess of cleaning Biotube® filters and AdvanTex textile sheets are available from Orenco.*
- *Turn off power to electrical components when working in splice boxes or the control panel or when disconnecting pumps.*
- *When finished, use proper personal hygiene.*

☐ **Odor of sample**

Sniff the sample and assess its odor. Record these observations about clarity (NTUs) and odor on the *Field Maintenance Report* form.

☐ **pH of sample**

☐ **Dissolved oxygen of sample**

Using pH test strips or a pH meter, check the pH of the sample and record it on the *Field Maintenance Report* form. Values from 6 to 9 are normal. Also check the sample's dissolved oxygen (DO) using a DO meter (or DO field test ampoules), and record that on the form. Values from 2.5 to 6 mg/L are normal.

☐ **Oily film in PVU**

☐ **Foam in tank**

Check the liquid in the pump vault (PVU) for an oily sheen, and the liquid in the first compartment of the tank for foam or other unusual appearance. Record your observations on the *Field Maintenance Report* form.

Performing Scheduled Field Maintenance (continued)

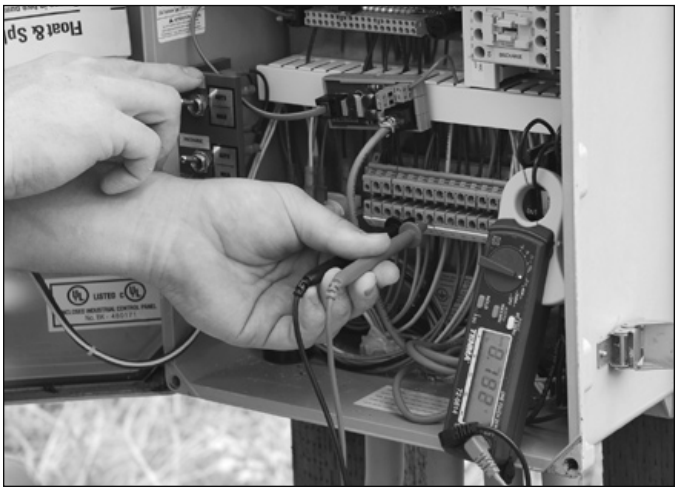
Check Control Panel

Open the control panel and place it in test mode.

☐ **Run amperage**

Check and record the run amperage of the recirculation pump and discharge pump. Place the clamp of an ammeter around the wire to each pump's circuit breaker and read the amperage while each pump is running. You can run the pump by holding the toggle switch on MAN. Amperage should be no more than the pump's maximum service factor amperage.

Release the switch to the AUTO position. Make sure the pump comes on as the timer cycles. Timer cycles are shortened to about 30 seconds in test mode.



☐ **Audible and visual alarms**

Check the operation of the floats and timers by lifting the float trees out of the tank and discharge basin and following the instructions clipped inside the panel door. Make sure that audible and visual alarms are activated when the appropriate float is raised or lowered.

☐ **Dial tone (telemetry only)**

For systems equipped with VeriComm® panels, use a phone line tester or a phone to verify the presence of a dial tone.

Inspect/Clean Recirc Pump System

☐ **Riser/Lid**

Make sure that the lid is intact, and replace it if necessary. Replace any missing lid bolts. Check for marks of liquid infiltration or exfiltration.

☐ **Splice box**

Open the splice box and make sure there is no water in it. If there is, remove the water with a sponge and repair the leak. If you disconnect any connections, do not reuse the wire nuts when you reconnect them — use new ones.

☐ **Float cords**

☐ **Floats**

Verify that the floats are in good condition and properly secured to the float tree. Verify that float cords are neatly wrapped inside the riser so that they cannot interfere with the operation of the floats. Clean floats by hosing or brushing them so that debris falls back into the tank, not into the pump vault.

☐ **Pump**

Turn circuit breaker off at service panel. Switch MOA and circuit breakers in control panel to "Off." Pull the pump and place it on a cleanable surface, like the riser lid, or in a plastic trash can. Check the intake screen; wash off particles as necessary. Record the kinds of particles in the Comments section of the *Field Maintenance Report* form and report findings to user (for preventive maintenance). Reinstall the pump, checking to make sure the discharge valve is open.

Performing Scheduled Field Maintenance (continued)

☐ **Biotube® Filter**

☐ **Biotube Pump Vault**

Clean the Biotube Filter at every visit. Make sure that the RSV is out. Slide Biotube cartridge out of vault. Hold Biotube cartridge over open inlet of tank or primary compartment. Carefully spray build-up into tank. (The Biotube Cradle, available from Orenco, holds the Biotube Filter on the lip of the riser and directs debris into the tank away from the pump vault.) Flush vault bottom.

☐ **Recirculating Splitter Valve**

Move the RSV from side to side to check that the balls move freely. Then verify that the liquid level in the tank is within the normal range. If it is low, the ball mechanism could be jammed in the seated position. If it is high, the RSV may not be making a tight seal when the balls are seated. Clean the balls and replace the balls or the cage if necessary. Don't replace the RSV in the tank until you're ready to leave the site.

Measure Sludge/Scum

Measure sludge and scum in both compartments of the tank, and record the measurements on the *Field Maintenance Report* form. Schedule pumping of the tank when the bottom of the scum layer is within 3 in. (75 mm) of the flow-through port of the tank baffle or when the sludge accumulates to within 6 in. (150 mm) of the flow-through port.

Note any unusual appearance or smell of the tank's contents, and consult the *Advanced Service Tips and Troubleshooting Guide*, available from your AdvanTex Dealer, if necessary. If you find kitty litter, sanitary products, excessive grease, or other material that shouldn't be in the tank, talk to the residents of the home and remind them not to flush those things.

Inspect/Clean AdvanTex Filter

Open the AdvanTex Filter pod.

☐ **Odor**

☐ **Biomat**

☐ **Bridging/Ponding**

Check that the odor and appearance of the biomat are normal. Pungent or unusual odor, ponding (excessive liquid), and bridging (excessive solids) are problems that need immediate attention. The *Advanced Service Tips and Troubleshooting Guide* can help you ascertain the cause. You may need to change the timer settings or discuss household habits with the system users.

☐ **Laterals/Orifices**

Inspect the orifice shields. A clean area around an orifice cover is a sign of a plugged orifice; clean these orifices out before cleaning the laterals.

To clean and flush the manifold, open the flush valves at the ends of the laterals and brush or jet the laterals.

☐ **Pod bottom**

Pull out a few sheets, inspect the pod bottom, and note any excessive buildup of debris. When you're done cleaning the manifold, remove the RSV from the tank, and run the pump for two or three minutes with the flush valves open and the RSV removed to flush debris from the pod's underdrain back into the tank. You can do this while you are performing other tasks. After flushing, close the flush valves and make sure the orifice covers are on more or less straight. Replace the RSV in the tank.

☐ **Intake vent**

Make sure that the ventilation intake is not damaged or blocked, and clean or replace it if necessary.

Performing Scheduled Field Maintenance (continued)

Inspect/Clean Discharge Pump System

- ☐ Riser/Lid
- ☐ Splice box
- ☐ Float cords
- ☐ Floats
- ☐ Pump

If there is a discharge pump basin, inspect it and its components. Clean floats and pump by hosing them. If you pull the pump, check to make sure the discharge valve is open after reinstalling.

Over time, solids may accumulate in the discharge basin. Use a trash pump to pump these solids into the inlet end of the processing tank.

Inspect/Service Other System Components

- ☐ Disinfection equipment
- ☐ Dispersal laterals/orifices

Follow the manufacturer's instructions to inspect and service other components of the system.

Additional Services Rendered

- ☐ Cleaned textile sheets?

You should not need to clean the textile sheets every year, but it may be necessary now and then. Don't clean them unless the buildup of biomat is bridging across the sheets, because removing too much of the biomat inhibits the system's treatment performance.

If you need to clean the sheets, remove the RSV so that solids can freely drain back to the tank. Then clean the sheets one by one with the AdvanTex Cleaning Wand, a hose, or a backpack pressure washer (at low pressure). Wash debris down into the pod, where it will drain back into the processing tank.

- ☐ Replaced UV items?
- ☐ Replaced/used other items?

Document any equipment replaced and any additional observations.

Final/Safety Inspection

Review the Field Maintenance Report form to ensure all activities have been performed.

- ☐ RSV reinstalled

If you haven't done so already, replace the RSV.

- ☐ Manifold reconnected and valves closed

Make sure that the flush valves at the ends of the AX20 laterals are closed.

- ☐ Lids bolted on

Replace all lids and tighten all lid bolts.

WARNING: *If lid bolts are missing, replace them with spares. If you have no spare lid bolts, fasten the lid with a self-tapping screw, and immediately call your Dealer for replacement bolts. If the lid is unbolted or if the lid or riser are damaged, be sure to securely block access to the tank opening before leaving the site. Open tanks are hazardous, and children or adults who try to enter them may be seriously injured, asphyxiated, or drowned.*

Performing Scheduled Field Maintenance (continued)

☐ **Control panel reactivated**

Make sure that all circuit breakers have been switched back on. The panel will automatically return from test mode to normal mode in 30 minutes. To manually return it to normal mode, hold down the alarm button on the front of the panel until the alarm chirps. Close and latch the panel, and lock it if necessary.

Summary/Recommendations

☐ **Treatment system is performing; no further action necessary.**

☐ **Call for service**

☐ **Tank needs pumping**

☐ **Other?**

Check-off or document final recommendation(s). Back at the office, schedule any necessary follow-up.

Comments

Record any additional observations from your visit on the *Field Maintenance Report* form, along with information about equipment repaired or replaced.

Fax the completed form to the number on the bottom. The automated system will record the completion of the site's visit and archive an image of the form on advantexservice.com for future reference.

Unscheduled Field Maintenance Report

AdvanTex® Field Maintenance Report
Unscheduled

Property Owner/Tracking #				Operator
Site Address				Contact Phone
AX Site ID #	County ID #	Pod #	RTU #/UL #	Date of Last Inspection

Dispatcher Comments

Date:_____ Time: _____

Notification of site condition

☐ Made by VeriComm® Monitoring System
☐ Made by Homeowner
☐ Other _____

Site condition at time of call

☐ Alarm ☐ Tank Overflow
☐ Odor ☐ Sewage Backup
☐ Other _____

Field Sampling/Observations

☐ Necessary ☐ Not necessary

NTU (15 ± NTUs)	pH (6-9)	DO (2-6)

Odor of Sample.

Typical ☐ Musty ☐ Earthy ☐ Moldy
Non-typical ☐ Sulfide ☐ Cabbage ☐ Decay

Conditions at site

Alarm On ☐ Yes ☐ No
(If yes, alarm type_____)
Tank Liquid Level ☐ Normal ☐ High ☐ Low
Pump Operational? ☐ Yes ☐ No
Circuit Breakers
Recirc. . . . . ☐ Tripped ☐ On ☐ Off
Discharge. . . . . ☐ Tripped ☐ On ☐ Off
Controls . . . . . ☐ Tripped ☐ On ☐ Off

VCOM® ATRTU Board: (if applicable)

Document the panel status by shading the appropriate inputs and outputs as indicated by the yellow and red LEDs.

Inputs	① ② ③ ④ ⑤ ⑥ ⑦ ⑧
Outputs	① ② ③ ④
Power (Green LED)	☐ On ☐ Off ☐ Flashing

Cause of Malfunction: ☐ Mechanical ☐ Process-Related

_____
_____
_____
_____

Services Rendered:

_____
_____
_____
_____

Parts Used: W = Warranty, B = Billable (✓ appropriate selection)

W	B	Item Number	Description

Notes/Final Recommendations:

☐ System performing; no further action needed ☐ Additional service needed

_____
_____

Final/Safety Inspection:

Lids bolted on? ☐ Yes ☐ No
(If damaged, comment _____)
Control Panel reactivated? ☐ Yes ☐ No
Circuit Breakers:
Recirc: ☐ On ☐ Off Discharge: ☐ On ☐ Off Controls: ☐ On ☐ Off

Time at Site	Travel Time	Total Time

Signature _____

Date _____ **Time** _____

Fax completed form to 1-866-384-7404

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Performing Unscheduled Field Maintenance

Unscheduled Maintenance Procedures

If you receive an alarm call or phone call that requires a visit to an AdvanTex site, download the *Field Maintenance Report: Unscheduled* from www.advantexservice.com. The top of the form should be pre-filled with information about the site. If any information is missing, fill it in.

Depending on the type of problem that caused the alarm, you may not need to check all the boxes — they're just there to reduce the amount of writing you have to do. But do use the notes areas to record any repairs or adjustments you make, and to document anything unusual. These notes may help you on future service calls, and they help Orenco and your Dealer identify patterns of problems.

We recommend that you send a copy of this form to the homeowners after your visit. This reinforces any advice you may give them about proper use of their system. It also reassures them that the VeriComm® monitoring system is working and that you are diligently maintaining their system.

Notification of Site Condition

- ☐ **Made by VeriComm Monitoring System**
- ☐ **Made by Homeowner**
- ☐ **Other** _____

Indicate whether you learned about the problem from the VeriComm system, from the homeowner, or some other way — perhaps from a neighbor.

Site Condition at Time of Call

- ☐ **Alarm**
- ☐ **Tank Overflow**
- ☐ **Odor**
- ☐ **Sewage Backup**
- ☐ **Other** _____

Describe the condition that prompted the alarm.

WARNING: *Do not enter tank. Entering a tank without proper confined space procedures and equipment can cause serious injury, asphyxiation, or drowning.*

Field Sampling/Observations

- ☐ **Necessary**
- ☐ **Not necessary**

If the cause of the problem is not immediately apparent, use proper techniques (described in the "Performing Scheduled Field Maintenance" section) to sample effluent from the RSV. Do this first so that subsequent activity will not contaminate the sample. Test the sample's clarity, pH, and dissolved oxygen, and record the results on the form. Also check the box that describes the odor of the sample.

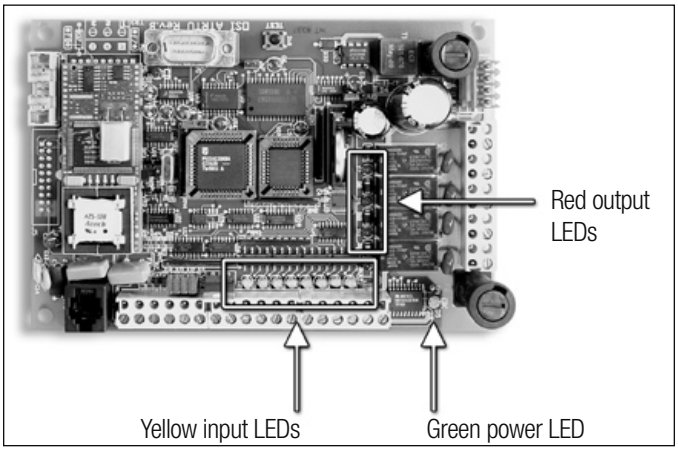
Conditions at Site

Alarm On	☐ **Yes**	☐ **No**	
(If yes, alarm type _____)			
Tank Liquid Level	☐ **Normal**	☐ **High**	☐ **Low**
Pump Operational?	☐ **Yes**	☐ **No**	
Circuit Breakers			
Recirc	☐ **Tripped**	☐ **On**	☐ **Off**
Discharge	☐ **Tripped**	☐ **On**	☐ **Off**
Controls	☐ **Tripped**	☐ **On**	☐ **Off**

Record the status of each part of the system on the form. Use the "Notes" field to describe problems in more detail.

VCOM ATRTU Board (if applicable)

Shade the appropriate circles to indicate which inputs (yellow) and outputs (red) are active on the ATRTU board inside the panel, and record the status of the green power light.



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Performing Unscheduled Field Maintenance (continued)

Cause of Malfunction

☐ Mechanical

☐ Process-Related

When you have found the cause of the malfunction, record whether it is a mechanical problem (such as failure of a float or loosening of a connection) or a problem with the biological processes in the system (such as recirculation ratio, system abuse, or insufficient ventilation). Describe the problem in as much detail as possible in the space provided.

Services Rendered

Describe what you did to correct the problem.

Parts Used

Record any new parts you installed. Check the appropriate box to show whether they are covered under warranty or billable to the customer.

Notes/Final Recommendations

Write down any observations about this incident that will be useful to you, the homeowner, your AdvanTex Dealer, or Orenco.

Final/Safety Inspection

WARNING: *If lid bolts are missing, replace them with spares. If you have no spare lid bolts, fasten the lid with a self-tapping screw, and immediately call your Dealer for replacement bolts. If the lid is unbolted or if the lid or riser are damaged, be sure to securely block access to the tank opening before leaving the site. Open tanks are hazardous, and children or adults who try to enter them may be seriously injured, asphyxiated, or drowned.*

Lids bolted on? ☐ **Yes** ☐ **No**

(If damaged, comment _____)

Control panel reactivated? ☐ **Yes** ☐ **No**

Circuit Breakers:

Recirc: ☐ **On** ☐ **Off**

Discharge: ☐ **On** ☐ **Off**

Controls: ☐ **On** ☐ **Off**

Verify the condition of system components upon leaving the site.

Time/Date/Signature

Record time at site and travel time.

Sign and date the form. Then fax it to the number at the bottom. The bar code at the top will ensure that a PDF of the form will go into the Service Provider's inbox on advantexservice.com, for assignment to the appropriate site.

Make a copy of the form and send it to the homeowner, along with the invoice.

Change of Service Provider Authorization

AdvanTexService.com

Change of Service Provider
Authorization Form

Property Owner		
Site Address		
Contact Phone	Pod #	RTU #/UL #

Fill this form out completely, have it signed by the Homeowner, and fax to 1-541-459-2884

Previous Service Provider: _____

New Contract Start Date: [ ]

Additional Comments: _____

_____

_____

_____

_____

_____

_____

_____
New Service Provider Company

_____
New Service Provider Signature Date

As the homeowner, you acknowledge that you are not under contract with any other Authorized Service Provider as of the "New Contract Start Date," noted above.

_____
Homeowner Signature Date

Fax completed form to 1-541-459-2884

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Changing Service Providers

Consistent maintenance is important to ensuring the excellent performance of AdvanTex Treatment Systems. So, when a service contract expires, it must be renewed, either with the existing service provider or with another Orenco-authorized service provider. Our Web site, advantexservice.com, provides tools to help with this effort.

When a service contract expires, contact the homeowners and offer a renewal. If the homeowners renew the contract, update the information in advantexservice.com.

If the homeowners do not renew the contract within 60 days, notify the Dealer (if the system is still under warranty) and make a note in advantexservice.com. If a service contract is required by law, notify the county or other regulatory jurisdiction as well.

When homeowners do not renew their service contract with their current service provider and select you to be their new service provider, you will need to have access to the site information for that system. Before meeting with the homeowners, you should log onto advantexservice.com and do the following:

- Print the *Change of Service Provider Authorization Form*.
- Fill out the form, including the site information, previous service provider's name, start date of the new contract, and any explanatory comments.
- Have the homeowners sign the form.
- Add your name, company name, and signature and fax the form to Orenco at the number on the bottom.

Once the form is received, you will have access to the site inform -ation for that system, so you can schedule the next service call. In addition, the automated system will archive an image of the form on advantexservice.com for future reference.

Appendix 1: AX20 Timer Settings Worksheet

The following chart shows recommended timer settings for a new system.

RESIDENTS	TIME ON (SEC)	TIME OFF (MIN)	NOTES
2	10 sec (0.17 min)	20.00	• Assumes water usage of 50 gal. (190 L) per person per day and a return recirculation ratio of 3 : 1 (Filter recirculation ratio of 4 : 1). • Override OFF cycle time is set at one-half of the OFF cycle time. Override ON cycle time is set the same as the ON cycle time.
3	15 sec (0.25 min)	19.75	
4	20 sec (0.33 min)	19.45	
5	25 sec (0.42 min)	19.70	
6	30 sec (0.50 min)	19.50	

As you gain experience with a system, you may conclude that you need to make adjustments, sometimes significant ones. This worksheet is intended to help you determine appropriate start-up timer settings (Pump ON, Pump OFF) for a single-pod AX20 system. Typical values and ranges are provided for each parameter. If you have any questions or if your values fall outside the desired ranges on this worksheet, contact your Dealer.

PARAMETER		TYPICAL VALUES	NOTES
	Number of people	3	Range of 2 to 8 people.
	Water usage per person	50 gpd (190 L/d)	Typical daily average is 50 gal. (190 L) per person.
Q_i	Actual daily flow (total)	150 gpd (570 L/d)	(Number of people) × (water usage per person).
R_b	Return recirculation ratio	3 : 1	You can adjust this ratio (return flow to forward flow) up or down depending on system performance. (Range of 2 to 6.)
R_f	Filter recirculation ratio	4 : 1	
	Total daily flow to AX20	600 gpd (2280 L/d)	(Actual daily flow) × (return recirculation ratio + 1). Must be ≤ 3000 gpd (11,370 L/d). Actual flow should not exceed 500 gpd (1895 L/d). (500 gpd × 6:1 R_b = 3000 gpd)
Q_d	Actual pump dose rate	33.3 gpm (126 L/min)	Determine this value by field-testing or by using Orenco's PumpSelect™. Start at the low end.
T_d	Pump ON cycle time (dose)	0.25 min	Select a value between 0.17 minutes (10 seconds) and 0.75 minutes (45 seconds).
T_r	Pump OFF cycle time (rest)	19.75 min	See Pump OFF equation below.

PUMP OFF EQUATION **EXAMPLE**

Plugging in the above values and rounding results in the following:

$$T_r = \left[\frac{1440 \cdot T_d \cdot Q_d}{(R_b + 1) \cdot Q_i}\right] - T_d$$

$$T_r = \left[\frac{1440 \cdot 0.25 \cdot 33.3}{(3 + 1) \cdot 150}\right] - 0.25 = 19.74 \approx 19.75$$

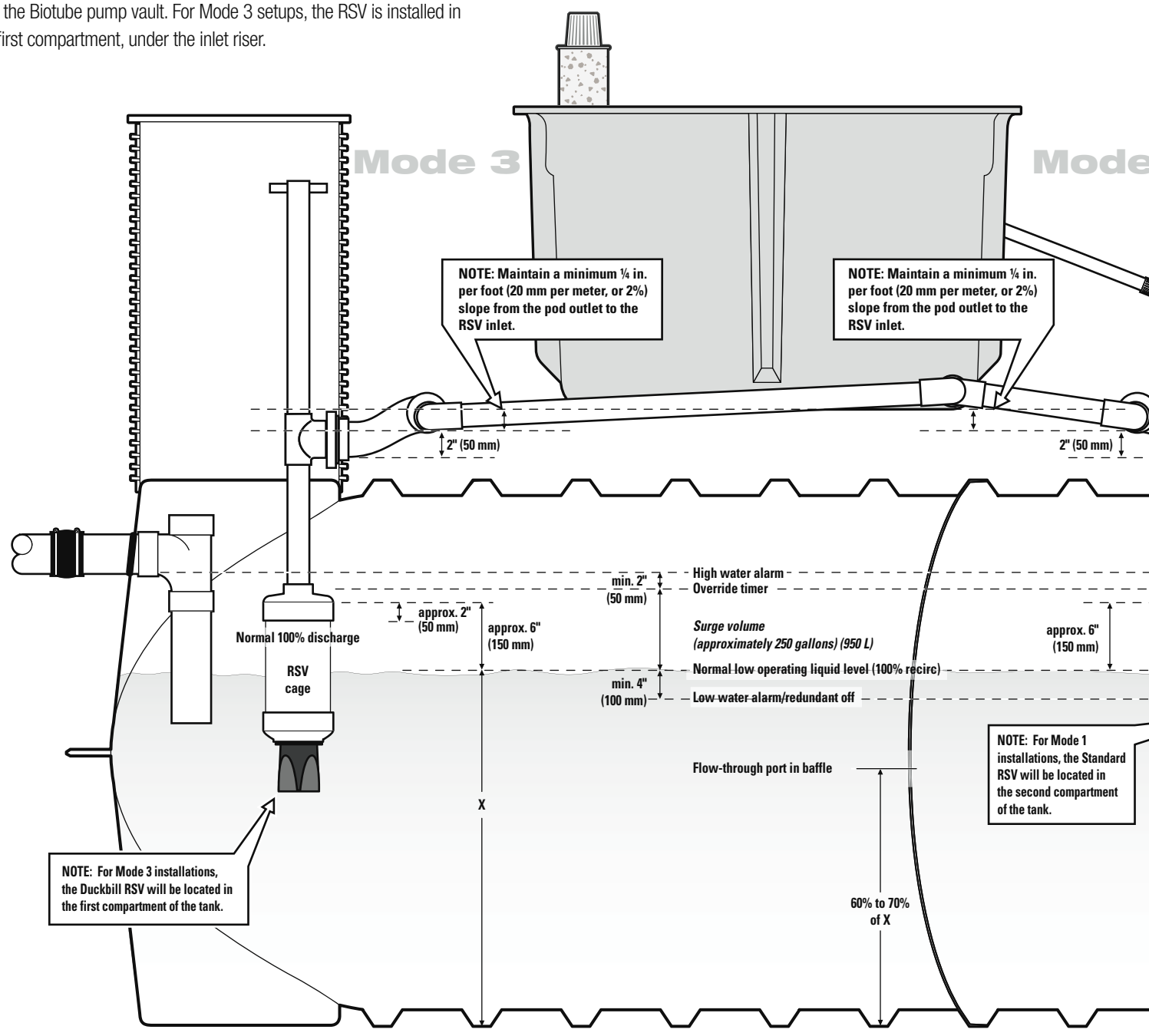
After you determine your Pump ON and Pump OFF times, double check to make sure your start-up settings fall within the cycle time (CT) range, below. If they don't, make adjustments per the "Note."

ADDITIONAL PARAMETERS		TYPICAL VALUES	NOTES
CT	Cycle time	20 min	Low flow applications may result in cycle times of an hour or more, which can cause the media to dry out or odors to develop in the recirc tank. If CT is much more than 30 minutes, consult your Dealer or Orenco for suggested adjustments.
	Pump cycles per day	72 cycles	1440 min/day ÷ (OFF cycle time + ON cycle time). Must not exceed the pump's maximum rated cycles of 300 cycles per day.
	Gallons per cycle	8.3 gal. (31 L)	With 68 orifices and using the T_d range recommended above, you will maintain the recommended 0.08 to 0.25 gal. (0.45 to 0.95 L) per orifice per dose.

Appendix 2: Float and RSV Settings

Orenco will provide the float and RSV settings for tanks that are approved for use with AdvanTex Treatment Systems in your area. Service Providers are simply required to verify that the float and RSV settings are correct.

This diagram shows how these settings are established for AdvanTex Treatment Systems that use a VeriComm® Control Panel. The diagram shows both a Mode 1 and a Mode 3 setup. For Mode 1 setups, the recirculating splitter valve (RSV) is installed in the second compartment, with the Biotube pump vault. For Mode 3 setups, the RSV is installed in the first compartment, under the inlet riser.



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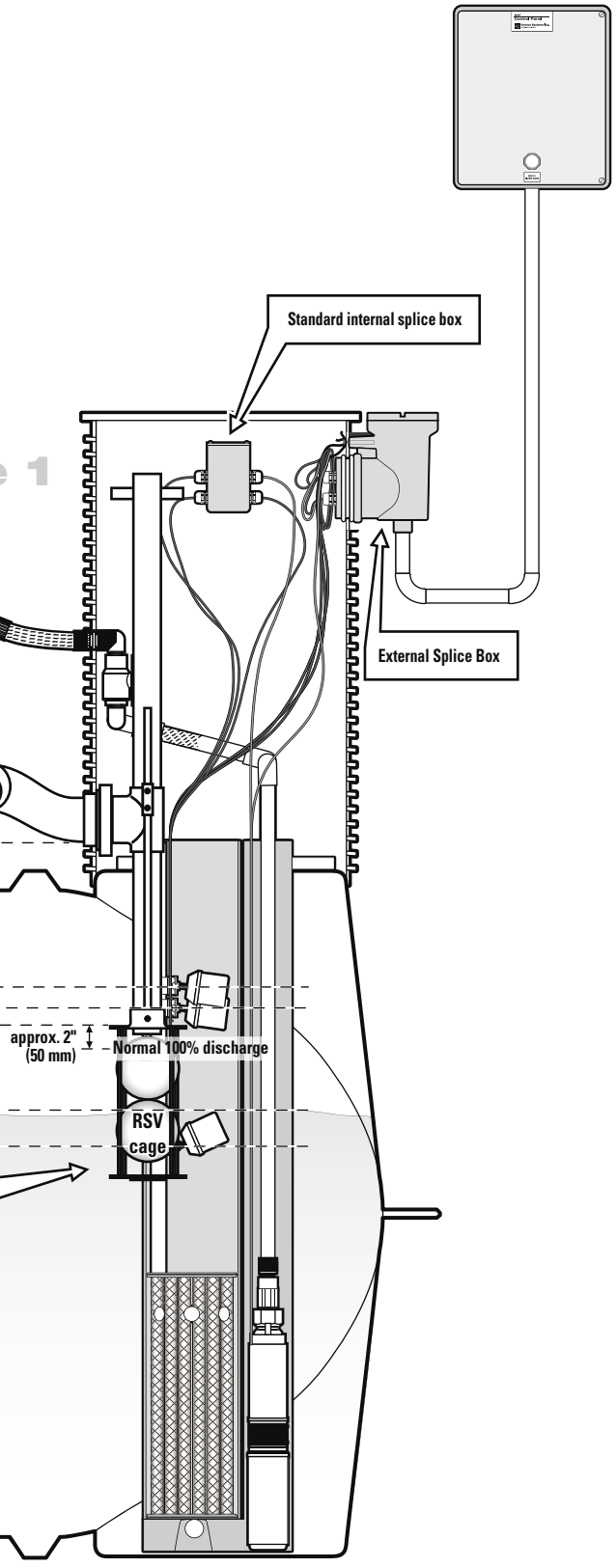
Appendix 2: Float and RSV Settings (continued)



Typical RSV Levels

For stinger pipe lengths up to 24 in. (600 mm) long, the "normal low operating liquid level" will be approximately 5-6 in. (125-150 mm) below the top of the RSV cage. (The normal low operating liquid level is the level at which 100% of the filtrate returns to the tank.) For most residential applications, the recommended surge volume — the volume between the low liquid level and the high water alarm float — is approximately 250 gallons (950 L). For Mode 3 installations, the duckbill model RSV, which has a flexible PVC tube that vents the RSV cage to atmosphere, is required.

Typical Float Levels

Be sure to check the plans for any site-specific or tank-specific float settings. The top float is normally set equal with the tank's invert of inlet. The bottom float should be approximately 4 in. (100 mm) below the normal low operating level.

NOTE: *Before leaving the site, verify that the "low water alarm/redundant off" float is positioned at least 10 in. (250 mm) below the top of the RSV cage.*

Notes

O&M MANUAL

Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

800-348-9843
541-459-4449
www.orenco.com
www.vericomm.net

AdvanTex Treatment System AXN Models meet the requirements of ANSI-NSF Standard 40 for Class I Systems.

Part 2:
Advanced Service Tips and Troubleshooting Guide

O&M MANUAL

Orenco Systems®
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Changing the Way the World Does Wastewater®

1-800-348-9843
www.orenco.com
www.vericomm.net

Introduction

As an authorized AdvanTex® Service Provider, you play a crucial role in Orenco's AdvanTex Program.

Orenco has always advocated regular, professional servicing of all onsite systems ... not just during the warranty period but for the life of the system. Regular servicing optimizes the treatment process and protects the property owner's investment. It also ensures that onsite systems protect public health, protect the environment, and are viewed as a reliable, sustainable technology.

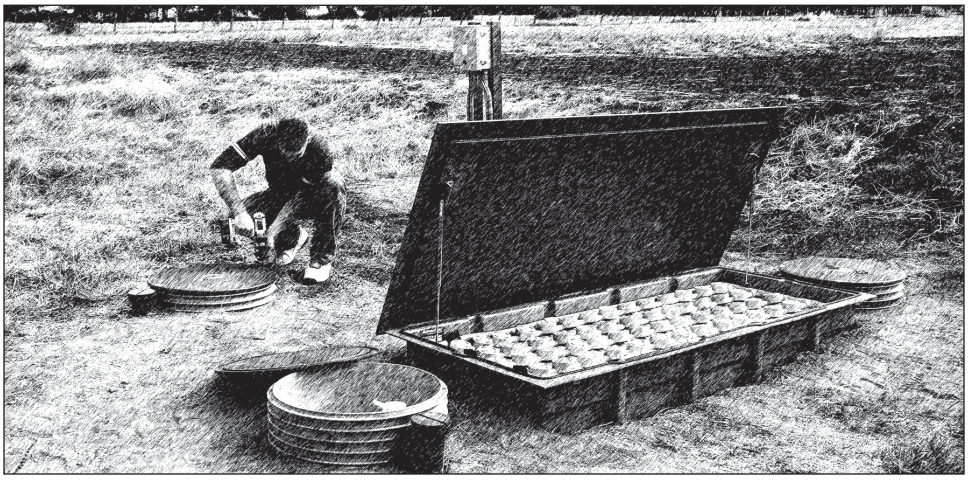
Orenco relies on you to perform the AdvanTex system start-up, do routine (scheduled) maintenance, and respond to calls for unscheduled maintenance (alarm calls). We also rely on you to keep in contact with the homeowners or property owners, review the *Homeowner's Manual* with them, advise them on preventive maintenance, and work to keep the system under a continuous service contract. Equally important, we rely on you to keep good service records on the system, creating a "history" of its performance.

To make your job easier, Orenco has created one of the most service-friendly and trouble-free onsite systems on the market. AdvanTex is a packed bed (media) filter. And media filters are the most suitable technology for onsite wastewater treatment because they are reliable and provide consistent, high-quality effluent. We then paired our media filter with a remote telemetry control panel, to allow you to "view" the system right from your computer. And we've provided a Web-based business tool — advantexservice.com — to help you file and retrieve system data automatically, schedule service events, and manage service technicians.

Finally, we've provided classroom and field training, as well as support materials, like this O&M Manual. Please read it thoroughly, and refer to it often.

We're very proud of our AdvanTex Treatment System. Like all our products, it has gone through extensive research, development, and field-testing. Then each component is built to written specifications and subjected to quality review, before shipping. In addition, our AXN models meet the requirements of NSF-ANSI Standard 40 for Class I Systems.

Thank you, in advance, for your knowledge, your conscientiousness, and your good work.



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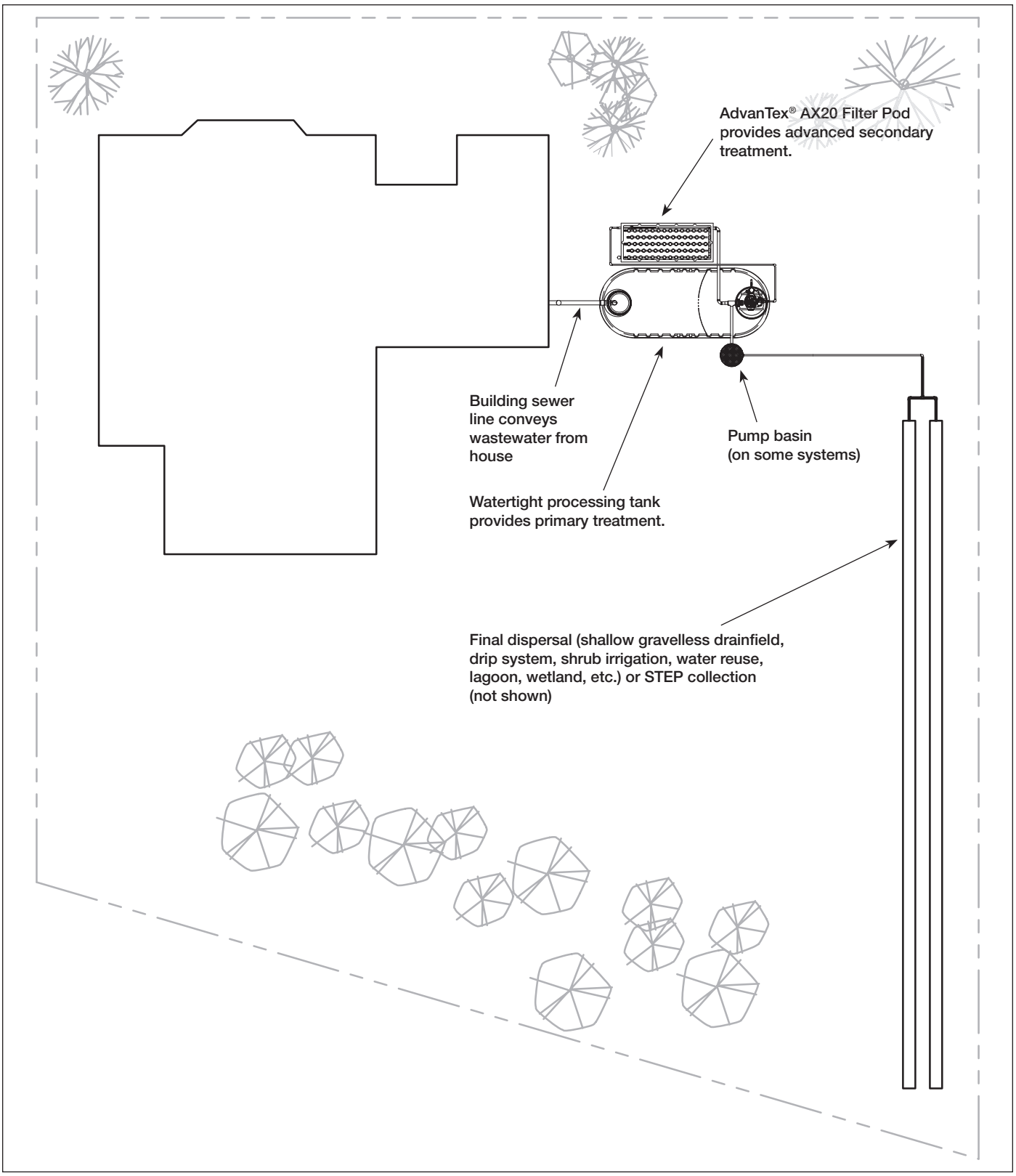
Typical Site Plan for an AdvanTex® Treatment System



How the AdvanTex Treatment System Works

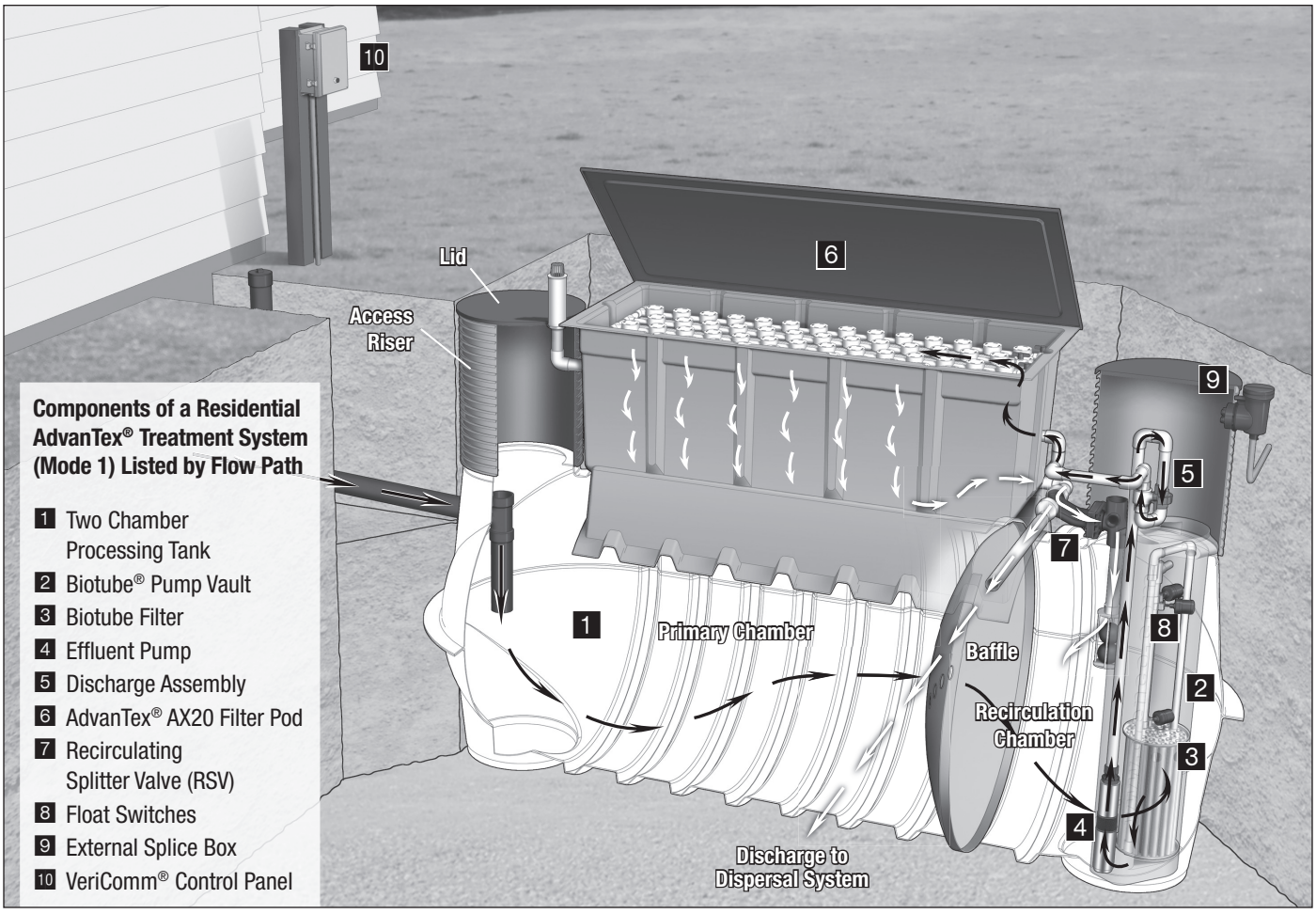
The AdvanTex Treatment System consists of a watertight processing tank and the AX20 textile filter pod. Wastewater from the home flows to the tank, where natural biological and physical processes provide primary treatment. In the primary chamber of the tank, the wastewater separates into three layers: a floating scum layer, a bottom sludge layer, and a relatively clear layer of liquid effluent in the middle.

From the secondary chamber, a pump draws liquid effluent through the Biotube® filter and sends it to the AX20 pod. There, the effluent is sprayed over hanging sheets of porous synthetic textile media. Microorganisms live in this moist, oxygen-rich (aerobic) environment. As effluent trickles over and through the sheets, the microorganisms break down the contaminants and eliminate them.

Effluent recirculates between the tank and the AX20 pod. In Mode 1, the most common configuration, the effluent recirculates to the second compartment of the tank. In Mode 3, effluent recirculates to the first compartment. This mode is used where maximum removal of nitrogen from the effluent is required.

After recirculating several times, the effluent is discharged, either directly from the processing tank or after first being collected in a pump basin. Depending on the design for a particular site, the treated effluent may be discharged to a drainfield, an underground drip irrigation system, a constructed wetland, an effluent sewer (STEP) system, or a reuse system. The system may include equipment for ultraviolet (UV) disinfection before ultimate dispersal of the effluent.

Properly designed, installed, and operated, a Residential AdvanTex Treatment System can treat wastewater to 5 mg/L BOD_5 and 5 mg/L TSS. This level of treatment is better than what municipal wastewater plants provide. The system can also be configured to reduce nitrogen levels as required locally. When effluent treated in this way is dispersed to the soil, natural processes purify it further, and it eventually returns to the underlying water table, where it can be used again.



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Equipment List

Routine maintenance and troubleshooting require a variety of tools, equipment, and spare parts. We recommend that an Authorized AdvanTex Service Provider have the following items at hand:

For Routine Inspection and Maintenance

- Cordless drill with 3/16-in. Allen wrench for lid bolts on risers and pod
- Extra lid bolts
- Sludge and scum measuring device (e.g., Nasco Sludge Judge® for sludge and Orenco SMUG for scum)
- Hook for raising floats to test them
- Biotube® filter cradle (OM-BIOTUBECRADLE)
- Backpack pressure washer
- Trash pump (and generator, if pump is electric) for removing solids from discharge basin
- AX20 manifold brush (AX-LATERALBRUSH)
- AX20 sheet cleaning wand (AX-CLEANINGWAND)
- Handheld computer (PDA) with Bluetooth® Kit or laptop with null modem cable (optional, to turn pump on and off at a distance from the panel)
- Electrical tester (voltage and amperage)
- Phone line tester (available from RadioShack®)
- Dissolved oxygen (DO) meter or colorimetric ampoules
- Sample bottles with grab sample device
- Turbidity meter
- pH meter or pH test strips
- Test strips for nitrate, ammonia, alkalinity
- Tape measure
- Calculator
- A copy of the *AX20 Installation Instructions* (NIM-ATX-AX-1) and *AdvanTex O&M Manual Part:1 Start-Up and Routine Maintenance* (AIM-OM-ATX-1), for reference

For Repairs

- Adhesive (ADH100, SS140, SS115, SS845)
- Control panel parts (circuit breakers, motor contractors, relays)
- Effluent pumps
- Extension cord
- Flashlight
- Hand tools (pliers, wrenches, screwdrivers, drill bits, hammer, shovel, hand saw, etc.)
- Inspection mirror (e.g., Prototek "Mirror on a Stick")
- Plumber's snake
- PVC cement and primer
- PVC fittings (3/4 in. to 2 in.)
- PVC pipe (3/4 in. to 2 in.)
- Spare parts for downstream components (e.g. drip headworks, UV disinfection unit)
- Waterproof wire nuts
- Wire stripping/crimping tool
- Float switches

For Troubleshooting

- Digital camera
- Watch or timer
- A copy of Part 2 of the AdvanTex O&M Manual: *Advanced Service Tips and Troubleshooting Guide* (AIM-OM-ATX-2)

For Personal Hygiene and Cleanup

- Bleach/water solution
- Eye protection
- Hand cleanser
- Paper towels
- Protective clothing
- Rags
- Rubber gloves

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Factors Affecting the AdvanTex Treatment Process

Properly designed, installed, and operated, a Residential AdvanTex Treatment System can treat wastewater to 5 mg/L BOD_5 and 5 mg/L TSS. If treatment performance fails to meet that standard, the cause may be the design, installation, settings, or use of the system — or more likely, a combination of those factors. Here's what happens in each part of the system, and how each of these factors can keep the system from performing as well as it should.

Processing Tank

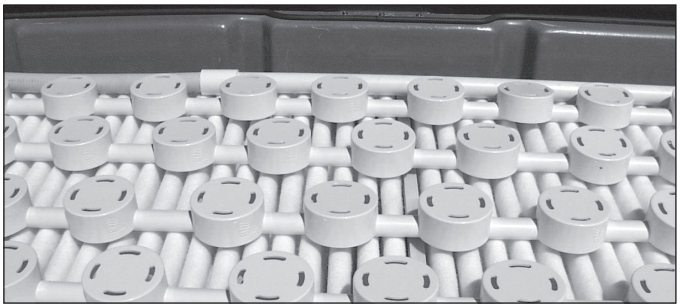
Primary treatment happens in the tank, and several conditions inside the tank affect the ultimate effluent quality. The first is the **incoming wastewater**: its strength (concentration), mass loading (amount of each wastewater component), hydraulic loading (volume), and chemical characteristics. Residential wastewater (raw influent) typically has BOD_5 of 450 mg/L, TSS of 500 mg/L, and total Kjeldahl nitrogen (TKN) of 70 mg/L. Practices in the home may raise the levels of these components and may also introduce harmful chemicals and indigestible solids into the system. Although the AdvanTex system is robust enough to accommodate a houseful of weekend guests or a couple of days of canning, residents must be aware that in the long run, certain habits can harm their septic system or increase the need for system servicing and/or pumping. The Troubleshooting section of this manual lists some household practices to inquire about when a system has problems.

In addition to the composition of a home's effluent, the **size of the tank** and the **volume of the effluent** also affect performance. Residential systems are sized and designed to accommodate the North American average of 50-60 gallons per person per day and are sized for a certain number of residents. A change in the number of residents, or a sudden increase in their water use per capita, can push wastewater through the tank without allowing the minimum 24 hours of retention time required for thorough separation and digestion of wastes.

Finally, the tank and all pipe joints must be **watertight** to prevent both infiltration and exfiltration of liquid. Infiltration of rainwater or groundwater will overload the system, preventing proper stratification in the processing tank and overloading the AdvanTex textile filter. Exfiltration of liquid effluent from the tank can make liquid levels too low for stratification, leading to clogging of the Biotube® effluent filter. Of course, exfiltration also pollutes the soil, and potentially the groundwater.

AdvanTex Textile Filter

The AdvanTex textile filter provides secondary wastewater treatment. The filter is a sturdy, watertight fiberglass basin filled with a nonwoven textile material. This lightweight, highly absorbent media treats a large amount of wastewater in a small space because it has a very large surface area — about five times greater than that of an equivalent volume of sand, for example. Textile also has a greater void volume (for free flow of oxygen) and greater water-holding capacity.



These properties make it an excellent environment for aerobic micro-organisms to live and digest the nutrients in effluent. As effluent from the processing tank percolates through and between the sheets of textile, the microorganisms remove what they need from it, reducing BOD_5 and TSS. Also, the aerobic conditions within the AdvanTex filter are ideal for microbes that convert ammonia to nitrates (nitrification). For sites where maximum denitrification is necessary, AdvanTex filters can be configured in Mode 3, so that the filtrate recirculates back to the high-carbon, low-oxygen environment at the inlet end of the processing tank, which is ideal for microbes that reduce nitrates to nitrogen gas (denitrification). Harmless nitrogen gas is then released back into the atmosphere.

In addition to being affected by **oxygen**, the AdvanTex filter's performance is affected by **mass loading, hydraulic loading, strength,** and **chemical characteristics** of the influent. If the effluent coming from the processing tank is contaminated with harsh chemicals or excessive grease, the biomat of microorganisms will suffer. The graphs on the next page show that low-to-moderate loading rates produce BOD_5 and TSS of <5 mg/L, and higher loading rates produce BOD_5 and TSS in the range of 15-25 mg/L.

About Recirculation Ratio

Maintaining an **appropriate recirculation ratio** is important for proper functioning of the system. Adjusting the frequency and length of the doses of effluent delivered from the tank to the AdvanTex filter optimizes the conditions for the microorganisms.

A recirc ratio that's too high can generate a highly aerobic biomat growth on the pump filter. It also increases alkalinity consumption and dissolved oxygen concentration in the processing tank, which can inhibit denitrification. Conversely, a recirc ratio that's too low can tend to liberate periodic odors during dosing events. The optimum ratio is typically between 2:1 and 6:1.

Normal Performance of the AdvanTex System

The table below summarizes the typical levels of BOD_5, TSS, and TKN in each part of the AdvanTex system, if proper conditions (described in the preceding section) are met:

Typical Values in the AdvanTex Treatment System

	BOD_5 (mg/L)	TSS (mg/L)	TKN (mg/L)
Raw Influent[1]	450	500	70
Primary Chamber Effluent	150	40	70
Secondary Chamber Effluent[2]	15-40	10-20	[4]
AXN Filtrate[3]	5	5	[4]

[1] Source: Crites and Tchobanoglous. *Small and Decentralized Wastewater Management Systems*, p. 180, 183, 1998. McGraw-Hill. Based on 50 gpcd.

[2] Will vary with recirc ratios and mode configuration. The numbers here represent a recirc ratio between 2:1 and 6:1 and are derived from Orenco and third-party testing in Mode 1.

[3] Actual performance results, based on a six-month accumulative average from NSF (National Sanitation Foundation) testing on the AX20N at 500 gpd, using composite sampling. Performance and servicing frequencies will vary relative to the mass load being treated. Procedures for treating excessively high loads will require engineering review. For more information, please review AdvanTex Design Criteria.

[4] Dependent on treatment system configuration and recirc ratios.

When all parts of the AdvanTex system are operating correctly and the component values in each part are within the limits above, the typical values or properties from field tests of AdvanTex effluent (filtrate) are summarized in the table below.

Typical Values for AdvanTex Effluent (Filtrate)

Parameter	Sampling Method	Typical Values or Properties
Clarity	Visual[1]	Clear (≤15 NTUs)
Odor	Sniff[2]	Non-offensive (musty is OK; rotten egg or cabbage is not OK)
Biotube® filter	Visual	No liquid level differential inside/outside vault, one-year cleaning interval
Oily film	Visual; inside the pump vault	None; no red, blue, green, or orange sheen
Foam	Visual; inside tank	None
pH	Field[3]	6-9
DO	Field[3]	≈2.5-6

If effluent is cloudy or smells pungent or if the biomat on the textile filter appears greasy, waxy, or oily, laboratory tests of the filtrate will aid troubleshooting. Following are the typical values for various lab tests of AdvanTex filtrate.

[1] To check for clarity, service providers can carry a portable turbidity meter or calibrated turbidity standards.

[2] To check for odor, service providers can simply sniff the effluent sample or can use a sulfide measuring packet or an olfactory snifter device.

[3] To check for pH, service providers can use litmus paper, a pocket pH meter, or a benchtop pH meter.

Typical Values for Supplemental Lab Tests

Sampling Parameter	Sampling Method	Typical values[1] (mg/L)	
		Mode 1	Mode 3
BOD_5	Grab	≈10	≈10
TSS	Grab	≈10	≈10
TN	Grab	≈25	≈10-20[2]
G&O	Grab	<1	<1

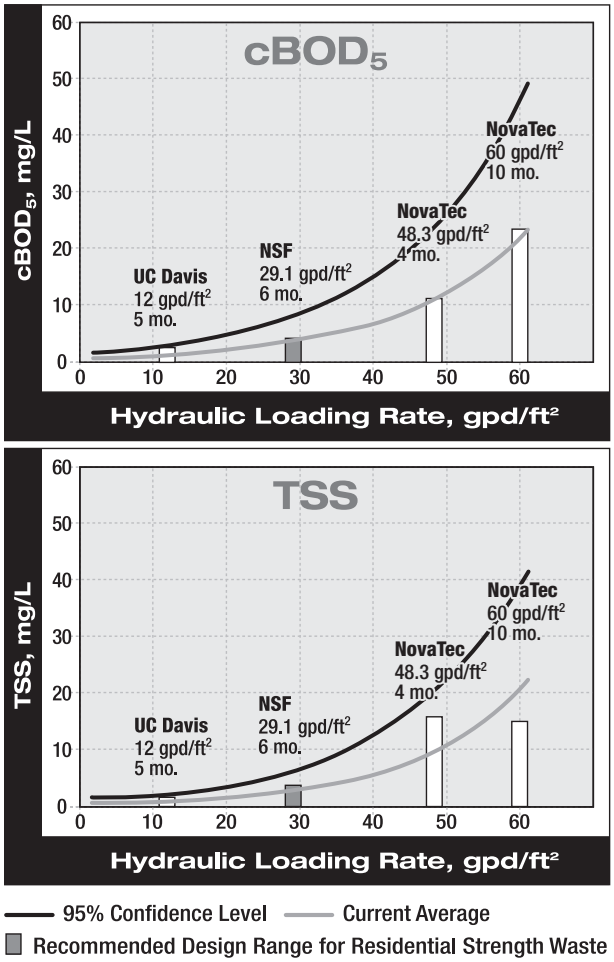
[1] Values are based on testing by Orenco and third parties.

[2] Typical nitrogen reduction ranges from ≈60-70%, with sufficient carbon source and alkalinity.

[3] To check for dissolved oxygen, use a DO meter or DO test kit.

Effluent Quality vs. Hydraulic Loading Rates

ANSI/NSF Standard 40 and Other Third Party Testing Results



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Troubleshooting Effluent Quality

Once you know the typical values for wastewater treatment system performance, you can be proactive and troubleshoot nontypical process indicators, before system performance is affected.

Low Effluent Quality

If your effluent samples are cloudy and color/turbidity is significantly higher than expected (greater than 15 NTU), do the following:

- Check the Biotube® filter for clogging.
- Check to see if the textile filter smells of chemicals (medication, chlorine, etc.) or has a granular or crusty appearance. (For example, a white crystalline crust could signal that water softener discharge or industrial strength detergents have been flushed into the system.)
- Check to see if the recirc ratio is too high or the pump dose time is too long. If the effluent $cBOD_5$ is high and TSS is low, a large amount of soluble $cBOD_5$ has not yet been consumed. That would likely be because the recirc ratio is too low for the influent strength or insufficient start-up time has elapsed. Typical organic reduction within the first 24 hours in residential systems is about 75% or greater. As the biomat begins to develop, greater reductions in the soluble $cBOD_5$ will occur (typically within the first 7-10 days). With a higher influent strength, the soluble $cBOD_5$ would not be readily removed until the biomat on the media is established.
- Check that ventilation is occurring, at the pod and from the house to the tank.
- Interview the users about system abuse, especially in the area of harmful chemicals, solvents, strong cleaning agents, or water softener backwash.

Special Note about Water Softeners: *Water softener backwash is extremely high in salts, which can disrupt system performance, especially nitrogen reduction processes. Talk with residents to make sure that no water softener backwash is discharging into the processing tank. Plumbing water softener backwash into the processing tank voids the warranty.*

If none of these troubleshooting steps makes a difference, lab tests may be necessary to determine the cause of the problem. Call Orenco for recommended lab tests or design remedies.

Odor

If the tank or textile filter smells like rotten eggs or cabbage:

- Check dissolved oxygen levels using a DO meter or DO wet test kit.
- Note filtrate DO levels that are <2.5 (less than 2.5) or >6 (greater than 6) mg/L.

Filtrate DO that's <2.5 mg/L indicates insufficient oxygen. If the filtrate DO is <2.5 mg/L:

- Check filter surface for evidence of clogging.
- Check that the pump is working.
- Check that ventilation is occurring, at the pod and from the house to the tank.
- Check that the recirc ratio isn't too low; increase if too low.
- Check that influent strength isn't too high (see AdvanTex Design Criteria).
- Check to ensure hydraulic retention time isn't too high.

Filtrate DO that's >6 mg/L indicates excessive aeration. If the filtrate DO is >6 mg/L:

- Check to ensure recirc ratio isn't too high.
- Check to see if influent flows are below normal.
- If influent flows are below normal or recirc ratio is too high, reduce recirc ratio.

Troubleshooting Other Symptoms

Biotube® Filter Clogging

If a visual inspection of the Biotube® filter for biomass build-up shows the need for cleaning more often than once a year (annual cleaning is typical for recirculating systems), try the following:

- Verify the pump isn't running too long (typically 3 cycles/hour).
- Ensure the recirc ratio isn't too high.
- Verify normal DO levels; if high, reduce recirc ratio.
- Check for below normal influent flows.
- Check influent Grease & Oil and TSS; if excessive, a review of component sizes may be required.

Oily Film

All signs of oil or grease anywhere in the system (in the tank, in the vault, on the effluent filter or textile filter) must be investigated. Ask the system user to identify the probable source:

- Recent change of car oil?
- Canning meat or poultry?
- Excessive use of garbage disposal?
- Excessive use of bath or mineral oils? (Jacuzzi® tub?)
- Excessive use of detergents?

If the system user can't identify the probable source, try the following:

- Sample and test at all process steps, including influent (if possible).
- Label, date, and photograph all samples.
  - When photographing, use standard glass beakers and set samples in front of a common, uniform background
- Check biomat accumulation at AdvanTex Filter.
- Note if biomat is yellowish and wax-like or lard-like. If so, scrape biomat sample for analysis:
  - Photograph/document biomat sample.
  - Send to lab with effluent samples.

Excessive grease and oil (>25 mg/L) is typically a design and management concern with commercial applications.

Foam

Foam rarely occurs in packed bed filters. If you see foam in the textile filter, call Orenco.

Troubleshooting Nitrogen Reduction

AdvanTex Treatment Systems do an excellent job of reducing nitrogen, especially in the Mode 3 configuration, where total nitrogen (TN)* is typically reduced to 10-15 mg/L, from typical influent total Kjeldahl nitrogen (TKN)** of 70 mg/L. Because many people purchase AdvanTex for its nitrogen-reducing capabilities, and because nitrogen reduction is a complex, many-staged process, it's important to understand the process, its related factors, the signs of effective nitrogen reduction, and how to keep the process optimized.

It's also important to know the TN limits required by the system user's permit. Some regulatory agencies have no requirement; some require a specific percentage reduction of a certain kind of nitrogen (90-95% nitrification of ammonia nitrogen, for example); and some require that TN be reduced to levels at or near drinking water quality at the point of final dispersal. A level of 20 mg/L TN is becoming increasingly accepted by regulators because it's typically achievable without relying on supplemental carbon and alkalinity feeds.

Finally, because influent characteristics greatly affect the amount of nitrogen reduction possible from any given system, it's vital to know the alkalinity of your waste source and the local or regional norms for organic and ammonia nitrogen.

* Total Nitrogen (TN) is the sum of organic nitrogen (ON), ammonia nitrogen (NH_3-N), nitrate nitrogen (NO_3-N), and nitrite nitrogen (NO_2-N).

** Total Kjeldahl Nitrogen (TKN) is the sum of organic nitrogen (ON) and ammonia nitrogen (NH_3-N).

The Process

Appendix 1 describes the nitrification/denitrification cycle in more detail, but a brief description should help you with most troubleshooting. In nitrogen reduction, ammonia is converted to nitrate in an aerobic environment, and then reduced through bacterial action in an anaerobic environment to nitrogen gas, which is released harmlessly to the atmosphere. Optimum nitrogen reduction typically requires the following:

- Adequate alkalinity of approximately 250 mg/L or higher (a lab test shows levels).
- pH of 6-9. Fixed-film microbial processes generally thrive between pH 6 and 9. Treatment problems typically result from rapid changes in pH rather than extreme long-term mean values, although long-term levels can result in less efficient process activity.
- Filtrate DO level of 2.5-6 mg/L, process tank DO level of <1 mg/L.
- Adequate time for the nitrifying bacteria to develop (one to three months).
- Adequate temperature (below 40° F retards the process).
- Good organic removal.

For a thorough description of the nitrogen reduction process, see Appendix 1. In residential wastewater, the ammonia level is typically about 60 mg/L and the TN is typically ≈70 mg/L.

Signs of Effective Nitrogen Reduction

Service providers frequently ask us, "How do I know if my wastewater treatment system is reducing nitrogen?" A thorough description of key indicators is included in Appendix 1. Following is a brief summary:

- Clear, odorless filtrate effluent (a "see and sniff" test is generally considered sufficient).
- Normal-looking biomat on the textile filter (light-brown to dark-brown and gelatinous in texture).

Additional filtrate tests will show ...

- Typically, low BOD_5, low turbidity and high clarity.
- DO of ≈ 2.5-6 mg/L.
- Low ammonia levels (≈<1-3) and relatively high nitrate levels, since nitrification converts ammonia to nitrate.

Troubleshooting Nitrogen Reduction (continued)

Troubleshooting Nitrogen Reduction

If you suspect that the system is not meeting expectations for nitrogen reduction, troubleshoot each of the critical factors that contribute to optimum nitrogen reduction, to determine a cause.

Filtrate Alkalinity Too Low — Sufficient alkalinity is required to achieve the desired degree of nitrification for any wastewater treatment system, because it takes 7.14 parts alkalinity to nitrify 1 part ammonia.

If filtrate alkalinity is too low:

- Check the recirc ratio; a high recirc ratio increases alkalinity consumption.
- Check influent TKN or ammonia levels and source alkalinity.

If a large quantity of nitrification is required, it may be necessary to add alkalinity-raising chemicals to the system.

Filtrate pH Too Low — Nitrification is particularly sensitive to pH but tends to thrive at levels between pH 7 and 8. The nitrification process releases hydrogen that consumes alkalinity and causes pH levels to drop. A pH level of <6 retards microbial activity of all kinds, including denitrification, and with a pH level <5.5, nitrification may show signs of degradation. Maintaining an alkalinity of 50 to 80 mg/L in the effluent is typically sufficient to maintain pH levels above 5.5. If the filtrate pH level is too low:

- Check influent alkalinity level (pH drops when too much available alkalinity is consumed).
- Check recirc ratios; reduce if too high.
- Ask system user about chemical discharges into the system, including carpet cleaners, chlorine, and photo developing agents.

Filtrate DO Levels Outside Range of 2.5-6 mg/L — If filtrate DO is too low (indicating insufficient oxygen), the system may release sulfide odors during dosing events, or there may be a more lasting smell within the filter pod. Try the following:

- Check for surface clogging/ponding and clean as necessary.
- Check air flow through the vent assembly.
- Check the recirc ratio; if it's too low (<2:1), increase as necessary.

If your filtrate DO is too high (indicating excessive aeration), it's likely that excessive recirculation or insufficient hydraulic retention time are factors. Try decreasing the recirc ratio.

High Filtrate Ammonia Levels — Because ammonia is biochemically oxidized to nitrate during nitrification, high ammonia levels are a sign that something is amiss. Try the following:

- Check for surface clogging/ponding and clean as necessary.
- Check for sufficient aeration (measure DO).
- Ensure no blockage of air flow into textile filter (indicated by thick biomat development or a build-up of grease and oils).
- Ensure no blockage in the manifold, causing ...
  - — Localized hydraulic overloading, saturation
  - — Short circuiting
- Check for sufficient alkalinity; if insufficient, consider supplemental buffering using equipment that automatically adds an alkaline compound to the system. Call Orenco Engineering for assistance, if necessary.

Troubleshooting Nitrogen Reduction (continued)

Low Filtrate Nitrate Levels — Residential packed bed filters normally yield more than 98% nitrification (conversion of ammonia to nitrate). Therefore, the ammonia levels in the filtrate should be low and the nitrate levels higher. Some denitrification occurs in the packed bed filter, so the normal nitrate level may vary. Be sure you are familiar with the mode of operation, as some AdvanTex modes are configured to produce lower nitrate levels. If it appears that nitrification is dropping off:

- Check the recirc ratio; adjust as necessary (high recirc ratios may drive pH too low for effective nitrification/denitrification, and low recirc ratios may not provide sufficient aeration).
- Verify incoming ammonia levels.
- Check recirc/blend for excessive organic food source (high BOD_5 may cause greater oxygen demand through the filter, reducing nitrification).

Adequate Time and Temperature — Nitrifying bacteria require one to two months to develop, and extremely cold temperatures (below 40° F) retard that process. If the AdvanTex Treatment System has been installed in a very cold climate, nitrification may not "kick in" for several months until warmer temperatures are reached. Typically, a June-September installation provides the necessary temperatures for a 30-60 day nitrification start-up time. Once nitrifiers colonize, they typically continue to nitrify through normal winter conditions. Only in severely cold regions should additional insulation be necessary.

Appendix 1: More Information about Nitrogen Reduction

Nitrogen removal (or "nitrification/denitrification") is a biochemical process. In nitrification, ammonia is oxidized to nitrate ($2NH_3$ converts to $2NO_3$ + $3H_2O$). This nitrate is then reduced through bacterial action (denitrification) to nitrogen gas, which is released harmlessly to the atmosphere.

During the nitrification process, about 9 parts oxygen are consumed in converting 2 parts ammonia to nitrate. Therefore, depending on the concentration of ammonia, a considerable amount of air may be needed. Other processes, like BOD_5 reduction, may occur simultaneously and further elevate the demand for aeration, especially if the organic level is high. In an abundance of air, all the aerobic or facultative microbes compete for their share of oxygen.

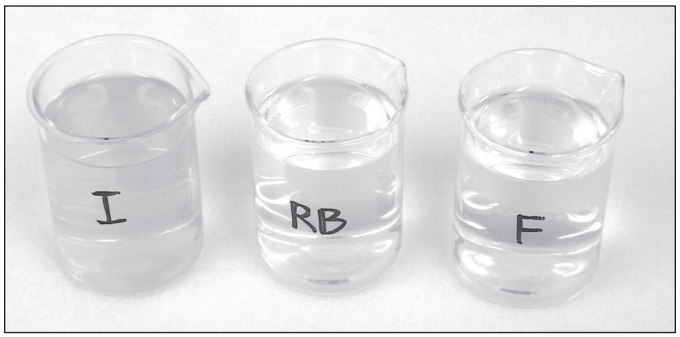
When the organic concentration is high, the microbes that oxidize organic matter, primarily the heterotrophic bacteria, are aggressive and tend to outcompete other microbes for the available free oxygen in solution. Ammonia is oxidized by autotrophic bacteria, which do not have as aggressive a growth rate, so if oxygen is not abundant, nitrification suffers. Consequently, the nitrification process usually lags until the organic concentration is depleted or until sufficient oxygen is present. At a 2.5:1 BOD_5/TKN ratio, the nitrifiers may only make up about 10 percent of the microbial population. At 0.5:1 BOD_5/TKN, the nitrifiers make up about 35 percent of the population.

In a filtering process, the filter column must be deep enough, or the filter media must be efficient enough at filtering organic particles, to deplete organic concentrations to a level in which a sufficient population of nitrifiers will be sustained. The physical (dimensional) features of the filter will vary depending on the media's characteristics — void ratio, moisture holding capacity, and effective surface area per unit volume ratio. Tankage, surge capacity, application rates, and loading characteristics are other design considerations that play a role in the sizing of the filter unit.

Performance Indicators

To judge the nitrogen-reducing performance (or potential) of any wastewater treatment system, be sure to check the following performance indicators:

Clear, Odorless Effluent — Simple, "see and sniff" tests can be performed easily in the field. Effluent from packed bed filters (recirculating textile filters, recirculating sand filters, intermittent sand filters) that are performing well should be clear (with turbidity <20 NTUs) and odorless.



Tests for Ammonia and Nitrate Nitrogen — If the system is oxidizing ammonia to nitrate (nitrifying), lab tests should measure relatively low ammonia levels and relatively high nitrate levels in the filtrate. Because nitrification responds to many and varying conditions within the aerobic treatment processes, *ammonia and nitrate nitrogen levels in the filtrate are the most ideal constituents to watch for any changes in performance.* Start-up times can be plotted, optimum recirc ratios can be gauged, cleaning frequencies can be predicted, and nonvisible clogging or saturation can be detected by watching either of these constituents.

Typical nitrification in single-family residential systems is expected to be in the 98-99% range. Investigate if the process appears to degrade by 5 percentage points or more.

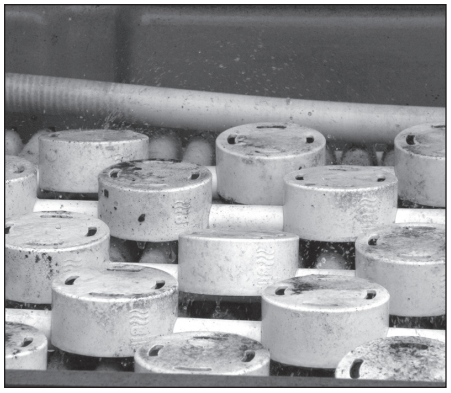
BOD_5 — The nitrification process requires oxygen, which is why nitrification is enhanced when BOD_5 is extremely low. Measures of filtrate BOD_5 should be <15 mg/L, although higher BOD_5 may not necessarily correlate with low levels of nitrification.

Typical influent characteristics are shown on page 8. When BOD_5 is high, there is a greater organic demand for oxygen, which may hamper the nitrogenous demand for oxygen. Increasing the recirc ratio should help establish oxygen balance.

Appendix 1: More Information about Nitrogen Reduction (continued)

Biological Growth on Filter — With "fixed film" treatment systems, biological growth on the filter media is natural. The biomat should appear light-brown to dark-brown in color and gelatinous in texture.

Dissolved Oxygen — Dissolved oxygen also provides critical information with which to diagnose how well a system is performing. Measures of DO should be in the range of 2.5 to 6 mg/L. If the DO level drops, the degree of nitrification will normally drop as well, which could be a sign of blinding or saturated flow conditions — anything that might inhibit free air from flowing into the system. (Nevertheless, it's quite possible to have low filtrate DOs and still have high effluent quality, as measured by BOD_5 and TSS levels.)



pH — For normal residential nitrogen loads, pH is typically maintained between 6 and 8.

Influent Characteristics — Influent characteristics (see page 9) will greatly affect the amount of nitrogen reduction that is possible from any wastewater treatment system. High solids and/or fats and cooking oils increase the oxygen demand and accumulation of material on and within the media, affecting the available oxygen for nitrification.

Alkalinity — The nitrification process releases hydrogen ions into solution, which tends to lower the pH level. Alkalinity is essential for nitrification. For each part ammonia that is nitrified, 7.14 parts alkalinity are consumed (buffering the acidity caused by the release of hydrogen ions). Consequently, if the degree of nitrification is less than expected, it could simply be a lack of sufficient alkalinity to support more. Typical residential nitrification requires alkalinity above about 250 mg/L for recirculating processes and double that for single-pass processes.

Many wastewater streams do not have sufficient alkalinity to support complete nitrification. In this case, nitrification may deplete the alkalinity, and pH may drop to a level that retards the microbial activity (<6). Recirculating the effluent helps, since half the alkalinity can be restored in the recirc or process tank, wherever denitrification occurs (and adjusting the recirc ratios may also bring the pH back to preferred operating levels). But wastewater streams that are alkalinity-starved can't provide for 100% nitrification.

The use of low flush fixtures can reduce nitrification performance. Low flush fixtures tend to reduce hydraulic loads, which causes elevation of wastewater constituents (i.e., higher concentrations of BOD_5, TSS, TKN, etc.). In this case, the available alkalinity in the water supply may not be adequate to accomplish the full level of nitrification desired.

These constraints exist for all wastewater treatment operations, regardless of whether the operation involves a suspended growth contact stabilization process or an attached growth packed bed filter. Packed bed systems will perform better, especially if they have a large attached growth surface area per unit volume ratio, because the micro-sites near the attached side of the biomat, where denitrification typically occurs, return some of the alkalinity. Textile packed bed filters, because of their large surface area per unit volume ratio, tend to perform even better.

Nevertheless, additional buffering may be necessary to accomplish the level of nitrification desired. In low alkalinity conditions, pH adjustment can be made with the addition of quicklime or hydrated lime, soda ash, or caustic. If the alkali is to be introduced at a process point preceding sedimentation zones, such as in the tank, lime would be preferred. Soda ash and caustic both contain sodium, which is a dispersant and will impede settling of solids in the tank.

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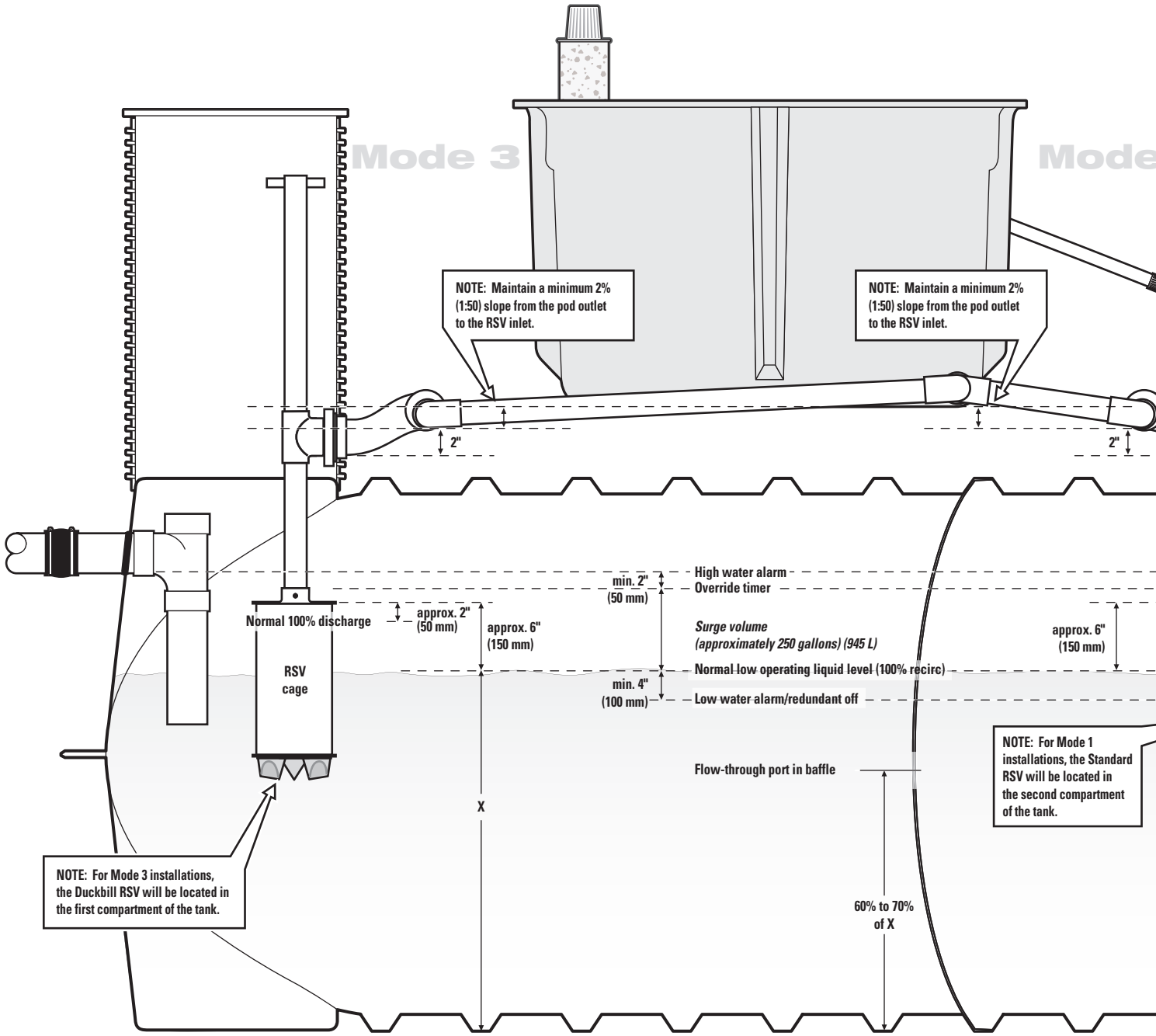
Appendix 2: Float and RSV Settings

Orenco will provide the float and RSV settings for tanks that are approved for use with AdvanTex Treatment Systems in your area. Service Providers are simply required to verify that the float and RSV settings are correct.

This diagram shows how these settings are established for AdvanTex Treatment Systems that use a VeriComm® Control Panel. The diagram shows both a Mode 1 and a Mode 3 setup. For Mode 1 setups, the recirculating splitter valve (RSV) is installed in the second compartment, with the Biotube pump vault. For Mode 3 setups, the RSV is installed in the first compartment, under the inlet riser.



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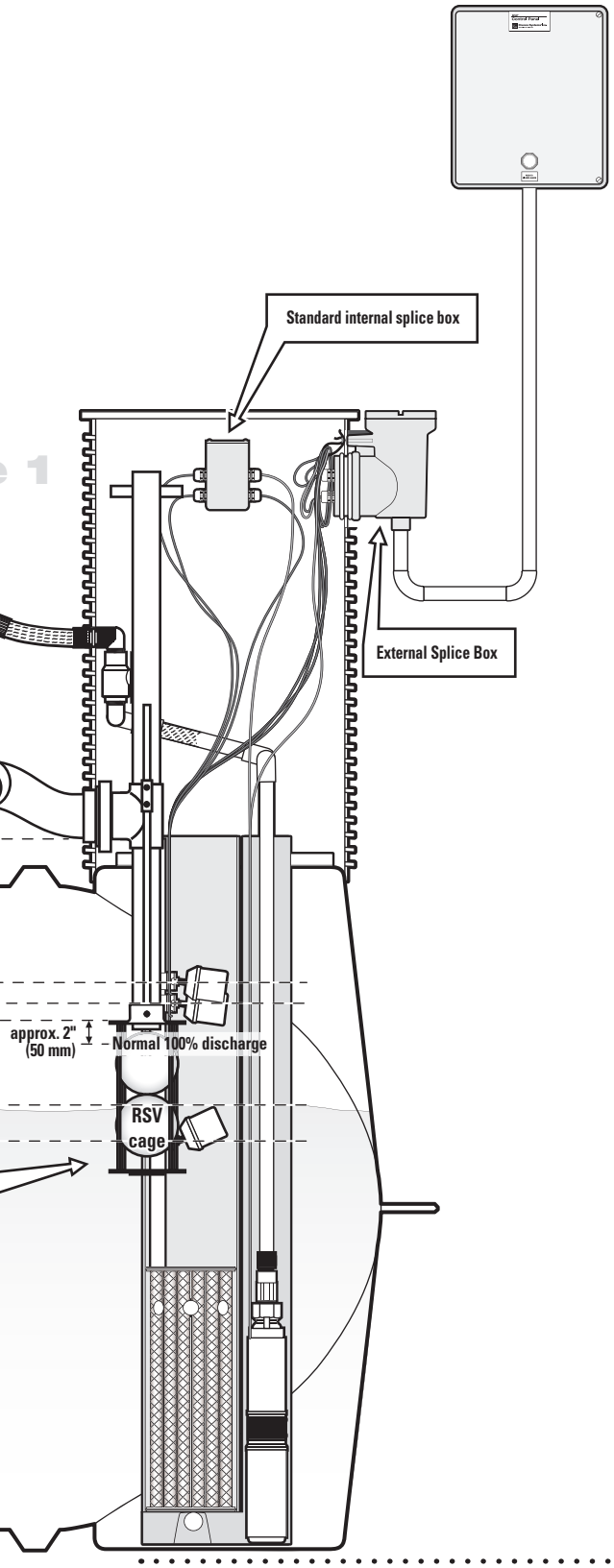
Appendix 2: Float and RSV Settings (continued)



Typical RSV Levels

For stinger pipe lengths up to 24 in. (610 mm) long, the "normal low operating liquid level" will be approximately 5-6 in. (127-152 mm) below the top of the RSV cage. (The normal low operating liquid level is the level at which 100% of the filtrate returns to the tank.) For most residential applications, the recommended surge volume — the volume between the low liquid level and the high water alarm float — is approximately 250 gallons (948 L). For Mode 3 installations, the duckbill model RSV, which has a flexible PVC tube that vents the RSV cage to atmosphere, is required.

Typical Float Levels

Be sure to check the plans for any site-specific or tank-specific float settings. The top float is normally set equal with the tank's invert of inlet. The bottom float should be approximately 4 in. below the normal low operating level.

NOTE: *Before leaving the site, verify that the "low water alarm/redundant off" float is positioned at least 10 in. (254 mm) below the top of the RSV cage.*

Appendix 3: Timer Settings

The following chart shows recommended timer settings for a new system.

RESIDENTS	TIME ON (SEC)	TIME OFF (MIN)	NOTES
2	10 sec (0.17 min)	20.00	• Assumes water usage of 50 gal. (190 L) per person per day and a return recirculation ratio of 3 : 1 (Filter recirculation ratio of 4 : 1). • Override OFF cycle time is set at one-half of the OFF cycle time. Override ON cycle time is set the same as the ON cycle time.
3	15 sec (0.25 min)	19.75	
4	20 sec (0.33 min)	19.45	
5	25 sec (0.42 min)	19.70	
6	30 sec (0.50 min)	19.50	

As you gain experience with a system, you may conclude that you need to make adjustments, sometimes significant ones. This worksheet is intended to help you determine appropriate start-up timer settings (Pump ON, Pump OFF) for a single-pod AX20 system. Typical values and ranges are provided for each parameter. If you have any questions or if your values fall outside the desired ranges on this worksheet, contact your Dealer.

PARAMETER		TYPICAL VALUES	NOTES
	Number of people	3	Range of 2 to 8 people.
	Water usage per person	50 gpd (190 L/d)	Typical daily average is 50 gal. (190 L) per person.
Q_i	Actual daily flow (total)	150 gpd (570 L/d)	(Number of people) x (water usage per person).
R_b	Return recirculation ratio	3 : 1	You can adjust this ratio (return flow to forward flow) up or down depending on system performance. (Range of 2 to 6.)
R_f	Filter recirculation ratio	4 : 1	
	Total daily flow to AX20	600 gpd (2280 L/d)	(Actual daily flow) x (return recirculation ratio + 1). Must be ≤ 3000 gpd (11,370 L/d). Actual flow should not exceed 500 gpd (1895 L/d). (500 gpd x 6:1 R_b = 3000 gpd)
Q_d	Actual pump dose rate	33.3 gpm (126 L/min)	Determine this value by field-testing or by using Orenco's PumpSelect™. Start at the low end.
T_d	Pump ON cycle time (dose)	0.25 min	Select a value between 0.17 minutes (10 seconds) and 0.75 minutes (45 seconds).
T_r	Pump OFF cycle time (rest)	19.75 min	See Pump OFF equation below.

PUMP OFF EQUATION **EXAMPLE**

Plugging in the above values and rounding results in the following:

$$T_r = \left[\frac{1440 \cdot T_d \cdot Q_d}{(R_b + 1) \cdot Q_i}\right] - T_d$$

$$T_r = \left[\frac{1440 \cdot 0.25 \cdot 33.3}{(3 + 1) \cdot 150}\right] - 0.25 = 19.74 \approx 19.75$$

After you determine your Pump ON and Pump OFF times, double check to make sure your start-up settings fall within the cycle time (CT) range, below. If they don't, make adjustments per the "Note."

ADDITIONAL PARAMETERS		TYPICAL VALUES	NOTES
CT	Cycle time	20 min	Low flow applications may result in cycle times of an hour or more, which can cause the media to dry out or odors to develop in the recirc tank. If CT is much more than 30 minutes, consult your Dealer or Orenco for suggested adjustments.
	Pump cycles per day	72 cycles	1440 min/day ÷ (OFF cycle time + ON cycle time). Must not exceed the pump's maximum rated cycles of 300 cycles per day.
	Gallons per cycle	8.3 gal. (31 L)	With 68 orifices and using the T_d range recommended above, you will maintain the recommended 0.08 to 0.25 gal. (0.45 to 0.95 L) per orifice per dose.

Appendix 4: Glossary

Alkalinity: The amount of ions available in the filtrate to react with hydrogen ions. Although pH paper or a pH meter provides a quick field measure of the overall balance of acidity vs. alkalinity in the system and is useful for detecting changes that may cause problems, quantitative determination of alkalinity (measured in mg/L) is done in a lab.

BOD: Biological Oxygen Demand, a measure of the amount of organic material in wastewater. cBOD means carbonaceous BOD; the terms are often casually used interchangeably. $cBOD_5$ means "five-day cBOD" and is a lab test in which the sample is incubated for five days.

DO: Dissolved oxygen, in mg/L. It can be measured in the field using a DO meter or colorimetric kit, or in a lab.

G&O: Grease and oil, in mg/L, measured in a lab.

NTU: Clarity and color of wastewater can be measured in nephelometric units (NTU). Clarity of a sample in a glass container can be compared by eye against a prepared sample. To obtain a quantitative measure of turbidity, a turbidity meter can be used in the field or in a lab.

pH: A measure of the acidity or alkalinity of wastewater on a scale from 0 (acid) to 14 (alkaline), with 7 being neutral. pH can be measured in the field using pH test strips or a pH meter.

TN, TKN: Total Nitrogen (TN) is the sum of organic nitrogen (ON), ammonia nitrogen (NH_3-N), nitrate nitrogen (NO_3-N), and nitrite nitrogen (NO_2-N). Total Kjeldahl Nitrogen (TKN) is the sum of organic nitrogen (ON) and ammonia nitrogen (NH_3-N).

TSS: Total suspended solids, in mg/L, measured in a lab.

Notes

O&M MANUAL

NSF® NSF/ANSI STANDARD 40

AdvanTex Treatment System AXN Models meet the requirements of ANSI-NSF Standard 40 for Class I Systems.

OSI

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AdvanTex® O&M MANUAL

SUPPLEMENTAL INFORMATION, AX20-RT

Introduction: AdvanTex® AX20-RT Treatment Unit Operation

This supplement contains information to help you successfully operate and maintain an AdvanTex® AX20-RT Treatment Unit. The AX20-RT operates similarly to the AdvanTex AX20 Treatment System, but there are some differences to be aware of when performing O&M activities. A big difference is that the AX20-RT consists of a single, self-contained module for recirculation, treatment, and dosing, instead of separate units.

Another difference is that the AX20-RT has no Recirculating Splitter Valve (RSV). Effluent percolates down through the textile media and is split — by means of a tank baffle — between the recirculating side and the discharge side of the AX20-RT recirculating treatment tank.

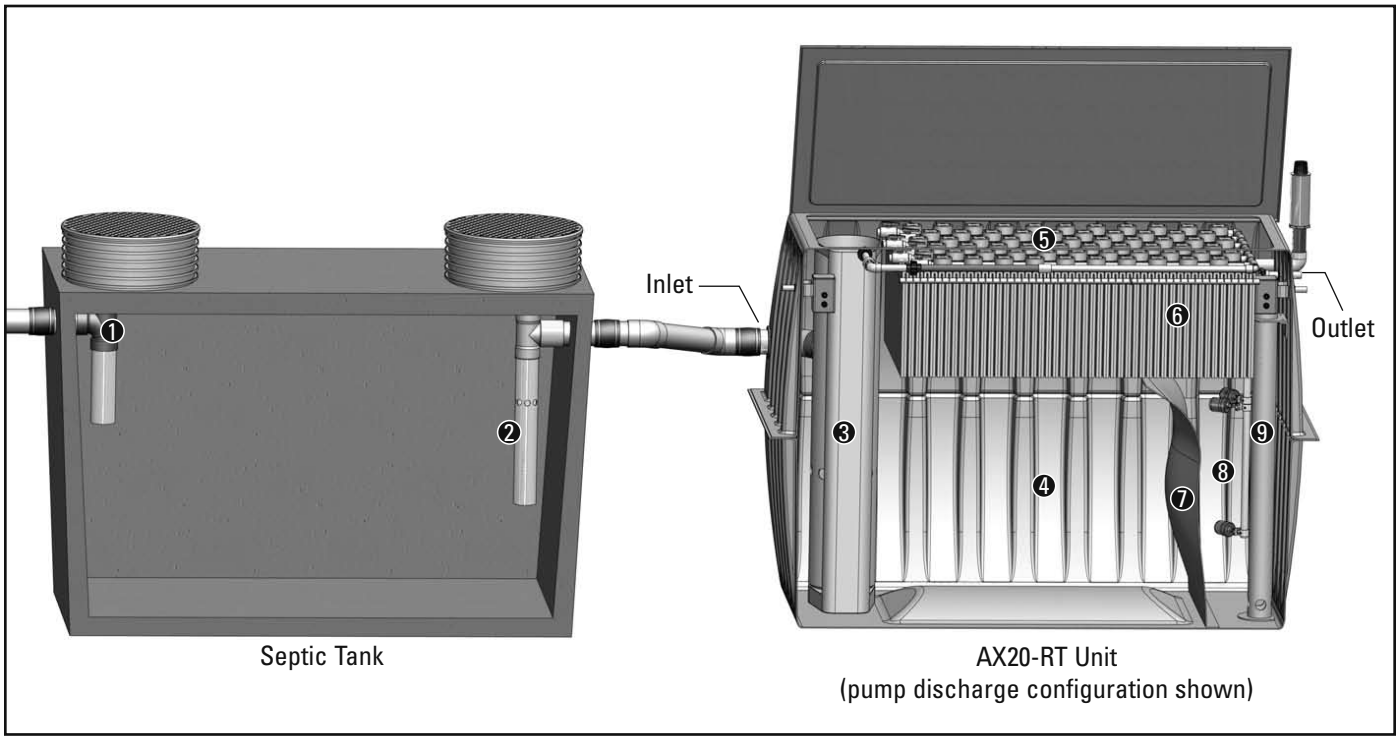
The Advantex AX20-RT Treatment System has 10 main functional areas and components:

1. Septic Tank Inlet Tee
2. Biotube® Effluent Filter
3. Biotube Pump Package
4. Recirculating Treatment Tank (recirc side)
5. Manifold and Laterals
6. Textile Media
7. Tank Baffle
8. Recirculating Treatment Tank (discharge side)
9. Flow Inducer and Discharge Pump Assembly
10. Control Panel (not shown)

Effluent from the clear layer in the septic tank passes through a Biotube® effluent filter and is discharged by gravity to the recirc side of the AX20-RT unit, which contains a Biotube Pump Package. The Biotube Pump Package pumps filtered effluent from the recirc side of the AX20-RT unit's recirculating treatment tank to the distribution manifold in the top of the unit.

The operation of the pump on the recirc side of the tank baffle is controlled by a timer in the control panel, which allows the pump to dose the textile media for short periods (usually a half-minute or less), typically 72 times a day. This frequent "microdosing," which optimizes the treatment process, occurs 24 hours a day to maintain the proper biological environment.

Treated effluent can be discharged to the drainfield by means of a flow inducer and discharge pump or by gravity discharge. The "High Level Alarm" and "ON" floats for the discharge pump are set at the factory and are non-adjustable. Dose volume for the pump discharge is determined by adjustments to the "OFF" float. AX20-RT units with gravity discharge simply discharge when the level of treated effluent in the discharge side of the tank is at the level of the discharge outlet.



Septic Tank

AX20-RT Unit
(pump discharge configuration shown)

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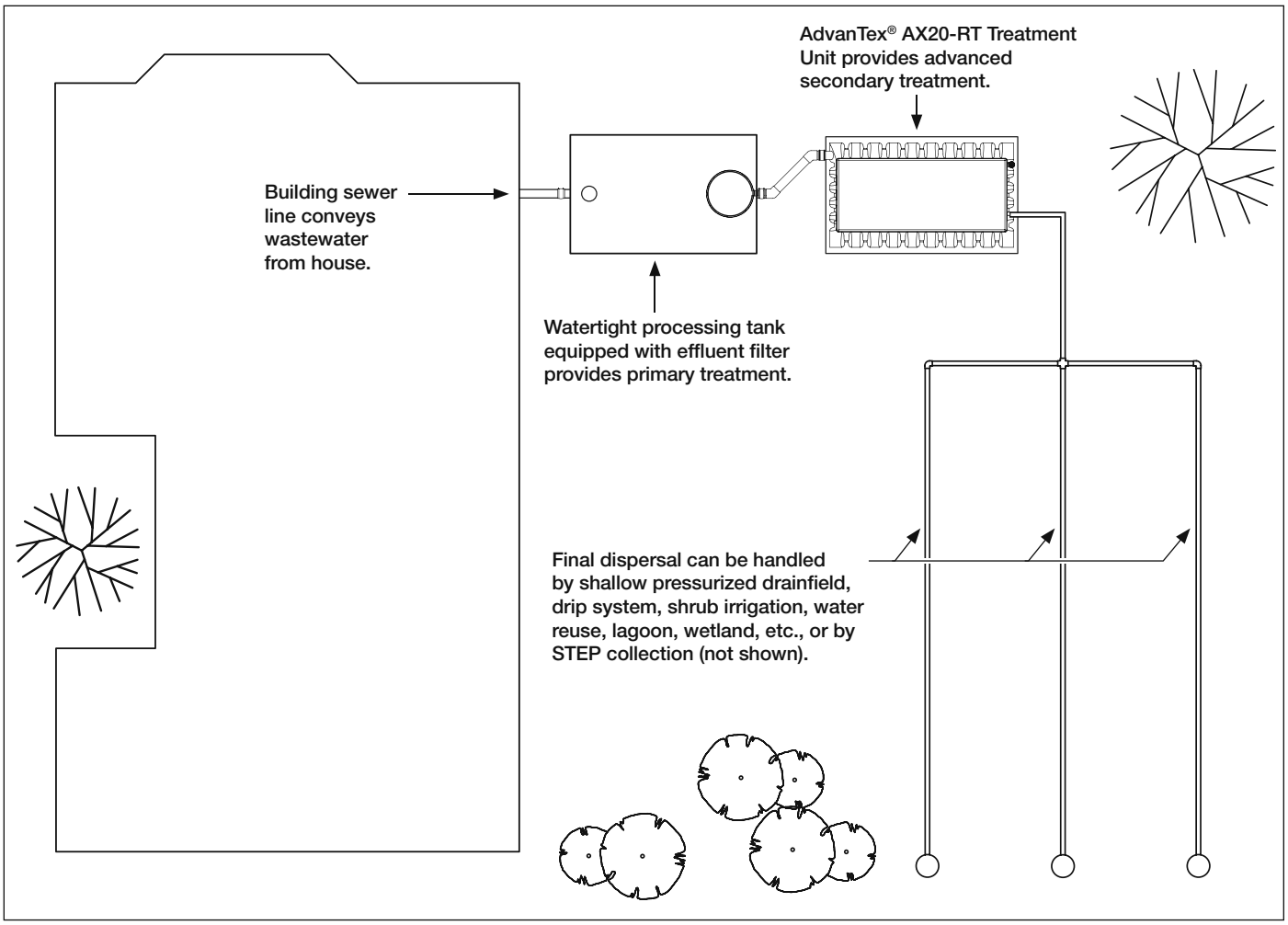
Typical Site Plan for an AdvanTex AX20-RT Treatment Unit



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AdvanTex O&M Manual: Changes Specific to the AX20-RT

The following shows AX20-RT-specific information not found in Parts 1 and 2 of the *AdvanTex® O&M Manual* that are relevant to operating and maintaining the AdvanTex AX20-RT Treatment Unit. Use the general information found in the *O&M Manual* along with this information to start up and properly service AX20-RT systems.

Start-Up Checklist Changes

Primary Treatment

Note: *All pumping equipment is contained in the AX20-RT unit. Substitute the checklist item below for the checklist items in the "Process Tank Pumping Equipment" and "Process Tank Pumping System" sections.*

Septic Tank

☐ Biotube® filter installed correctly on the septic tank outlet.

Secondary Treatment

Note: *There is no recirculating splitter valve (RSV) or separate discharge basin in an AX20-RT system. Floats in the Biotube® Pump Vault Unit (PVU) are set at the factory for correct performance. Do not adjust the floats in the PVU. Substitute the checklist items below for the checklist items in the "Secondary Treatment" section.*

AX20-RT Unit

☐ AX20-RT unit installed level.

☐ All piping properly covered and compacted.

Ventilation System

☐ Passive air vent on AX20-RT unit properly installed.

Biotube® Pump Vault Unit

☐ Floats operate properly.

☐ Pump plumbing connected correctly to manifold.

Biotube Pump Vault Operation

☐ Pump operates in "Manual."

☐ Pump operates in "Automatic."

☐ Pump run amps:_____

☐ Pump rest volts:_____ run volts:_____

AX20-RT Filter Operation

☐ Squirt height verified.

AX20-RT Discharge Unit (pump discharge only)

☐ Floats operate properly.

☐ Pump discharge plumbing connected correctly.

☐ "Off" float adjusted for correct discharge dose to dispersal.

Setting Discharge Flow Volume

The AX20-RT is pre-set at the factory for a discharge flow volume of 42.5 gal/dose (161 L/dose). If necessary, use the discharge pump "Off" float to make adjustments to the discharge flow volume. Each 1-in. (12.7 mm) increase or decrease in "Off" float height is equal to approximately 4 gal. (15 L) change in volume.

Do not adjust the settings of the "High-Level Alarm" and "On" floats.

Table 1. Dose Volume Information

Pump gal./min (L/sec)	10 (0.6)	20 (1.3)	30 (1.9)	50 (3.2)
Factory float setting*, in. (mm)	25 (635)	25 (635)	25 (635)	25 (635)
Lowest "Off" setting, in. (mm)	16 (406)	18 (457)	20 (508)	24 (610)
Max dose volume, gal. (L)	76 (288)	68 (257)	64 (242)	56 (212)

**Settings are measured from the bottom of the discharge side of the AX20-RT unit.*

Perform Field Sampling

When you arrive at the site, remove the lid from the AX20-RT and take your sample from the discharge side of the AX20-RT unit before doing anything else, so that the sample won't be contaminated by material that you stir up while working.

When you collect effluent samples, be careful not to touch the textile sheets, unit walls, or other components. Disturbing the sheets, walls, or other components could contaminate the samples. Also, be sure to thoroughly clean and dry your sampling device between uses to avoid cross-contamination.

Measure Sludge and Scum

Measure sludge and scum in the process tank AND on the recirc side of the AX20RT. Follow the instructions for pumpouts found in the *AdvanTex O&M Manual* for the process tank.

NOTE: *A light buildup of solids is expected to form in the AX20-RT unit over time. After the second year that the system is in use, we recommend measuring solids accumulation in the AX20-RT whenever you perform regularly scheduled maintenance.*

If more than trace amounts of scum or solids are found in the recirc side of the AX20-RT unit, check the distribution side of the unit for solids and scum, schedule a pumpout, and begin troubleshooting the system. The *Advanced Service Tips and Troubleshooting Guide* can help you determine the cause. You may need to change timer settings or discuss household habits with the system users.

Notes

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AdvanTex® FAQ

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Q. Since one of your AdvanTex models received NSF approval under the NSF/ANSI Standard 40 testing protocol (which is primarily used for aerobic treatment units), does that mean your product is an ATU?

A. Not in the way the term "ATU" is currently understood. ATU is an acronym for "Aerobic Treatment Unit," but it has evolved into industry shorthand for technologies that use a "suspended growth" treatment process. (This process involves pumping air into a liquid medium, where waste-eating microbes are grown, "suspended" in the liquid). By contrast, AdvanTex Treatment Systems are packed bed filters that use an "attached growth" treatment process. (Attached growth uses physical filtration devices on which waste-eating microbes are grown.)

Since both these treatment processes use oxygen, technically they are both Aerobic Treatment Processes; the differences in performance, however, are significant. Suspended growth processes in residential applications are typically on-demand, gravity-discharge and rely solely on complete mixing and the biochemistry of aeration to treat waste. Any disruption of this delicate biochemical process (peak loads, power outages) can cause untreated waste to gravity right through the unit and into the drainfield.

In contrast, attached growth packed bed filters like AdvanTex are typically time-dosed, pump discharge and use both biochemical AND physical removal treatment processes. So they can handle peak loads reliably and no untreated waste is bypassed under any circumstances. Attached growth packed bed filters have other benefits as well: quick start-ups, low O&M costs, and low power consumption.

Q. Are your AdvanTex textile filters a new technology?

A. Yes, but the textile filter treatment process is based on a proven technology: packed bed filters. At the end of this section, we've included a chapter on "Intermittent and Recirculating Packed Bed Filters" from the definitive textbook on decentralized waster water treatment: *Small and Decentralized Wastewater Management Systems* (Crites and Tchobanoglous, 1998). In that chapter, on page 714, there is a brief summary of the history of packed bed filters: "Early Development and History of Use." We've also included an article that discusses the use of textile media in wastewater treatment: "Performance of Packed Bed Filters," (T. Bounds, E. Ball, H. Ball, 2000). Additional documentation can be provided at your request.

Q. How can you take a 360-square-foot packed bed filter, like a sand or gravel filter, and compress it into just 10 to 30-square-feet?

A. Because of the increased surface area of the textile media, combined with its large void spaces and its water holding capacity. This is a treatment process based on sound science, incorporating fundamental principles of physics (mass loading), chemistry, and biology.

Q. Why does textile have such a bigger surface area and void space than sand or gravel?

A. Because the textile media is fibrous, not solid. With a solid grain of sand or gravel, only the outside surface area is available for the attachment of bacteria. With textile, the surface area around each and every fiber is also available. As a result, the surface area is more than 5 times greater than that of sand media.

Q. According to your research, you're loading your textile filters as high as 60 gpd / ft^2. That's much, much higher than the typical loading rates for intermittent sand filters (1.25 gpd / ft^2) and recirculating sand filters (5 gpd / ft^2). How can you do that?

A. There are a number of reasons why. The **first** reason is the larger surface area of the textile media, as noted in the previous question. The larger surface area gives greater colonies of bacteria an interface for oxygen exchange.

The **second** reason is the greater void space in textile media, which is about 5 times greater than that of sand. Void space does two things; it allows for a free flow of oxygen and provides a larger void for solids accumulation. Free flow of oxygen combined with a large interface for oxygen transfer optimizes bacterial digestion. The SAR (Solids Accumulation Rate) is a measurement of how long a filter will last before it clogs with organic and inorganic particles, as well as grease and oil. The greater the SAR, the longer life a filter will have.

The **third** is the greater water holding capacity of the textile media. An increased water holding capacity equates to a more sustainable environment for bacteria to live in. A poor water holding capacity creates an environment where bacteria dry out and sloughing can occur. Finally, water-holding capacity is important, because high water-holding capacity gives bacteria the time to digest organic waste. Textile media has about five times the water-holding capacity of sand.

It's important to note that these factors combine to allow substantial increases in loading rates. For example, one cubic foot of ISF sand media has about twice as much surface area as one cubic foot of RSF sand media. ISF sand media also has a better water holding capacity. However the loading rate of the RSF sand media is actually five times higher due to the greater void space. If we compare the sand medias, the ISF has more surface area and greater water holding capacity while the RSF has greater void spaces.

To conclude, textile media optimizes treatment with a large surface area, greater void space, and increased water holding capacity, which allows the combination of the best attributes of the ISF and the RSF into one compact, packed bed filter.

Q. How long will the media last?

A. The media should last indefinitely under normal domestic discharge conditions. The synthetic fibers are made of durable and biodegradation-resistant polymers.

Q. Will the media need to be discarded or replaced, and, if so, how frequently?

A. No. The media hang in aligned sheets. This style is built to accommodate solids accumulation, and, under normal conditions, should last indefinitely. It can be easily maintained by cleaning with a hose or pressure washer. We expect the nominal interval between cleanings to be several years, although, as with all biochemical processes, that will depend on the mass loading of the system. Also, the biomat that develops on the media is where treatment occurs, so excessive cleaning does not assure improved performance; maintenance should be done by a knowledgeable and qualified operator.

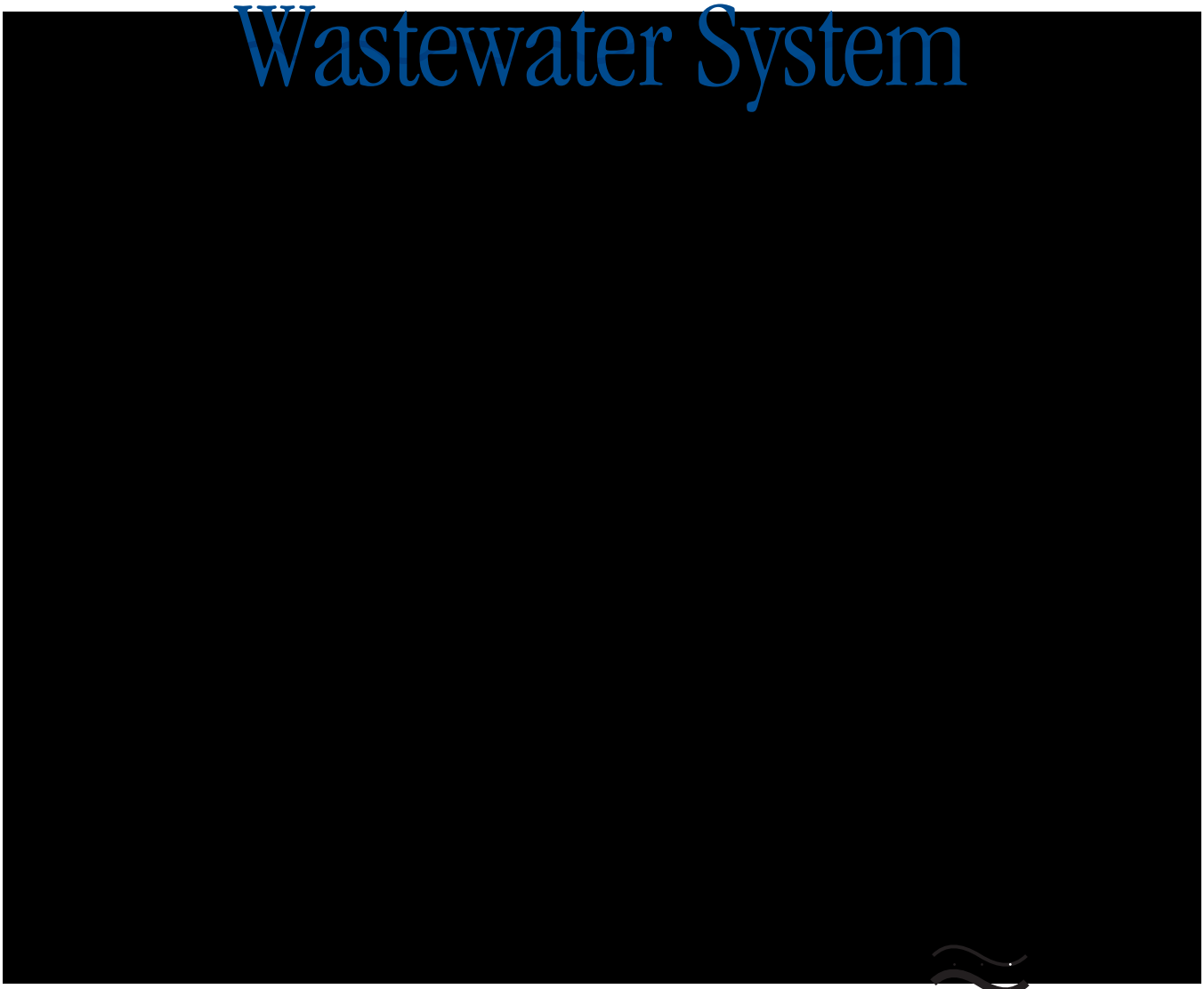
Q. Occasionally I see references to an "RX Series" textile filter. But most of your material discusses the "AX Series." What's the difference between the AX and the RX?

A. The AX Series uses aligned sheets of hanging textile material, while the RX Series – an earlier version of the product – uses random chips (aka "coupons") of textile material. The AX Series is a refinement of the technology and is the one we are now promoting except in regions that have approved the RX Series but have not yet approved the AX Series.

HOMEOWNER'S MANUAL

Onsite Wastewater Collection & Treatment Systems

How to Take Care of Your Wastewater System



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How to Take Care of Your Wastewater System

Congratulations!

Your home includes reliable, carefully engineered equipment — manufactured by Orenco Systems®, Inc. — for the collection and/or treatment of household wastewater.

When properly designed and installed, onsite wastewater treatment does a terrific job of decomposing household waste and recycling precious water resources. Our systems use little energy and frequently outperform municipal sewage treatment plants. The treated effluent is often returned harmlessly to the soil, where it receives final polishing and filtration for groundwater recharge. There's no degrading of our nation's rivers and oceans . . . which is so often the case with municipal sewage.

As with any engineered system, such as your car or your heat pump, your onsite wastewater system will work better and last longer if it is regularly maintained by a qualified service provider. Your service provider should be present during installation, so he or she is familiar with your system, especially those service lines, conduits, and connections that get buried.

And your service provider should have a copy of this manual. It's available on our Document Library, at www.orenco.com. Or call 800-348-9843 (541-459-4449) and we'll send you another.

Your system will also work better and last longer if you learn what can go into it — and what can not. Little effort is required. Just read and practice the "do's and don'ts" that follow. Every member of your household should be familiar with these. And if you have guests who want to "help out in the kitchen," be sure to tell them, too. With this preventive maintenance, along with periodic inspections, your onsite wastewater system should function for decades. And you'll save water, energy and pumpout costs, too!

There's a place on the back of this Homeowner's Manual to record "Important System Facts." If those have not been filled in for you, please record those now, before you file or shelve this manual. And give a copy of these facts to your service provider, especially if your service provider changes. You'll be glad you did.

Do's and Don'ts for INSIDE the House

There are a number of do's and don'ts that will help ensure a long life and minimal maintenance for your system. As a general rule, nothing should be disposed into any wastewater system that hasn't first been ingested, other than toilet tissue, mild detergents, and wash water. Here are some additional guidelines.

Don't flush dangerous and damaging substances into your wastewater treatment system. (Please refer to the "Substitutes for Household Hazardous Waste," on the next panel.) Specifically, do not flush . . .

- Pharmaceuticals
- Excessive amounts of bath or body oils
- Water softener backwash
- Flammable or toxic products
- Household cleaners, especially floor wax and rug cleaners
- Chlorine bleach, chlorides, and pool or spa products
- Pesticides, herbicides, agricultural chemicals, or fertilizers

Don't ignore leaky plumbing fixtures; repair them. A leaky toilet can waste up to 2,000 gallons (7500 liters) of water in a single day. That's 10-20 times more water than a household's typical daily usage. Leaky plumbing fixtures increase your water bill, waste natural resources, and overload your system.CVZ

Don't leave interior faucets on to protect water lines during cold spells. A running faucet can easily increase your wastewater flow by 1,000 to 3,000 gallons (4,000 to 12,000 liters) per day and hydraulically overload your system. Instead, properly insulate or heat your faucets and plumbing.

Don't use special additives that are touted to enhance the performance of your tank or system. Additives can cause major damage to other areas in the collection system. The natural microorganisms that grow in your system generate their own enzymes that are sufficient for breaking down and digesting nutrients in the wastewater.

Do collect grease in a container and dispose with your trash. And avoid using garbage disposals excessively. Compost scraps or dispose with your trash, also. Food by-products accelerate the need for septage pumping and increase maintenance.

Do keep lint out of your wastewater treatment system by cleaning the lint filters on your washing machine and dryer before every load. Installing a supplemental lint filter on your washing machine would be a good precautionary measure. (This normally takes just a few minutes. Lint and other such materials can make a big difference in the frequency and cost of pumping out your primary treatment tank.)

Do use your trash can to dispose of substances that cause maintenance problems and/or increase the need for septage pumping. Dispose of the following with your trash:

- Egg shells, cantaloupe seeds, gum, coffee grounds
- Tea bags, chewing tobacco, cigarette butts
- Condoms, dental floss, sanitary napkins, diapers
- Paper towels, newspapers, candy wrappers
- Rags, large amounts of hair
- "Flushable" wipes, baby wipes, medicated wipes, cleaning wipes

DON'T plumb water softener discharge brine into your wastewater system. (The softened WATER is OK, just not the BRINE that's produced during the regeneration cycle.)

DO route the brine around your wastewater system so it discharges directly into the soil. This is a cost-effective solution that ensures the long-term performance of your system and the biological processes that occur inside it.

Water softener brine interferes with nitrogen removal. And it degrades treatment by interfering with the settling process inside the tank. Without proper settling, solids, grease, and oils are carried through your system, clogging components. This increases your costs by...

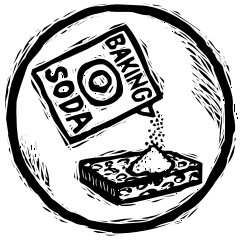
- requiring the tank to be pumped more often (at hundreds of dollars per pumpout)
- requiring filters to be cleaned more often
- fouling drainfields and other downstream equipment

Do's and Don'ts for INSIDE the House

Don't use excessive amounts of water. Using 50 gallons (200 liters) per person per day is typical. If your household does not practice any of the "water conserving tips" below, you may be using too much water.

Do conserve water:

- Take shorter showers or take baths with a partially filled tub. Be cautious about excessive use of large soaking tubs.
- Don't let water run unnecessarily while brushing teeth or washing hands, food, dishes, etc.
- Wash dishes and clothes when you have a full load.
- When possible, avoid doing several loads in one day.
- Use water-saving devices on faucets and showerheads.
- When replacing old toilets, buy low-flush models.



Do use substitutes for household hazardous waste. Replace the following hazardous products with products that are less environmentally harmful. The hazardous cleaners are listed below, followed by the suggested substitute.

Ammonia-based cleaners:

- For surfaces, sprinkle baking soda on a damp sponge.
- Or for windows, use a solution of 2 tbs (30 mL) white vinegar to 1 qt (1 L) water. Pour the mixture into a spray bottle.

Disinfectants:

Use borax: 1/2 cup (100 g) in a gallon (4 L) of water; deodorizes also.

Drain decloggers:

Use a plunger or metal snake, or remove and clean trap.

Scouring cleaners & powders:

Sprinkle baking soda on a damp sponge or add 4 tbs(50 g) baking soda to 1 qt (1 L) warm water. Or use Bon Ami® cleanser; it's cheaper and won't scratch.

Carpet/upholstery cleaners:

Sprinkle dry cornstarch or baking soda on, then vacuum. For tougher stains, blot with white vinegar in soapy water.

Toilet cleaners:

Sprinkle on baking soda or Bon Ami; then scrub with a toilet brush.

Furniture/floor polishes:

To clean, use oil soap and warm water. Dry with soft cloth. Polish with 1 part lemon juice and 2 parts oil (any kind), or use natural products with lemon oil or beeswax in mineral oil.

Metal cleaners:

- Brass and copper: scrub with a used half of lemon dipped in salt.
- Stainless steel: use scouring pad and soapy water.
- Silver: rub gently with toothpaste and soft wet cloth.

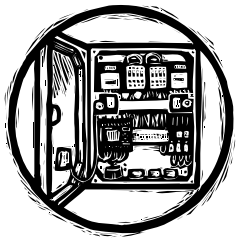
Oven cleaners:

Quickly sprinkle salt on drips; then scrub. Use baking soda and scouring pads on older spills.

Laundry detergents:

Choose a liquid detergent (not a powder) that doesn't have chlorine or phosphates.

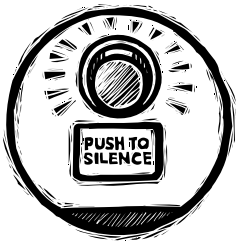
At the Control Panel



Do locate your electrical control panel where it will be protected from potential vandalism and have unobstructed access.

Do familiarize yourself with the location of your wastewater system and electrical control panel. Refer to the panel's model and UL number (inside the door panel) when reporting a malfunction in the system.

Do take immediate action to correct the problem in the event of an alarm condition. Call your system operator or maintenance company immediately whenever an alarm comes on. (It sounds like a smoke alarm.)



Do remember that the audible alarm can be silenced by pushing the lighted button located directly above the "Push to Silence" label on the front of the electrical control panel. With normal use, the tank has a reserve storage capacity good for 24-48 hours.

Don't turn off the main circuit breaker to the wastewater pumps when going on vacation. If there is any infiltration or inflow into the system, the pumps will need to handle it.

IMPORTANT! CAUTION!

Only a qualified electrician or authorized installer/operator should work on your control panel. Before anyone does any work on either the wiring to the level control floats and pumps in the vault or on the control panel itself, it is imperative to first switch the isolation fuse/ breaker and the circuit breakers in the panel to the "Off" positions, then switch "Off" the power to the system at the main breaker!

Do's and Don'ts for OUTSIDE the House

Don't enter your tank. Entering an underground tank without the necessary confined space entry training and procedures can result in death from asphyxiation or drowning. Keep children away from tank openings if lids are off or lid bolts are removed.

Do keep the tank access lid fastened to the riser at all times with stainless steel lid bolts. If the lid or riser becomes damaged, BLOCK ACCESS TO THE TANK OPENING, IMMEDIATELY.

Then call your service provider to repair it. If you or your service provider needs replacement bolts, call Orenco at 800-348-9843 or 541-459-4449.

Don't dig without knowing the location of your wastewater system. As much as possible, plan landscaping and permanent outdoor structures before installation. But easily removable items, such as bird baths and picnic tables, are OK to place on top of your system.

Don't drive over your tank or any buried components in your system, unless it's been equipped with a special traffic lid. If the system is subject to possible traffic, put up a barricade or a row of shrubs.

Don't dump RV waste into your wastewater system. It will increase the frequency of required septage pumping. When dumped directly into the pumping vault, RV waste clogs or fouls equipment, causing undue maintenance and repair costs. (Also, some RV waste may contain chemicals that are toxic or that may retard the biological digestion occurring within the tank.)

Don't ever connect rain gutters or storm drains to the sewer or allow surface water to drain into it. And don't discharge hot-tub water into your system. The additional water will increase costs, reduce the capacity of the collection and treatment systems, and flood the drainfield. It can also wash excess solids through the tank.

Do make arrangements with a reliable service person to provide regular monitoring and maintenance. Place the service person's phone number on or in your control panel!

Do keep a file copy of your service provider's sludge and scum monitoring report and pumpout schedule. This information will be beneficial for real estate transactions or regulatory visits.

Do keep an "as built" system diagram in a safe place for reference.

HOMEOWNER'S MANUAL

Onsite Wastewater Collection & Treatment Systems

Do keep accurate records of maintenance and service calls. Make sure whoever services your tank keeps a complete record, and ask for a copy for your records.

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IMPORTANT SYSTEM FACTS

Distributor or Dealer:

Please fill out the following important information before giving out this Homeowner's Manual:

Distributor/Dealer Name

Distributor/Dealer Address

Distributor/Dealer Phone Number(s)

Authorized Service Provider Name

Authorized Service Provider Phone Number(s)

Authorized Installer Name

Authorized Installer Phone Number(s)

Engineer Name (if applicable)

Engineer Phone Number(s)

Regulatory Agency

Regulatory Contact Name

Regulatory Contact Phone Number(s)

Permit # (if applicable)

Property Address

Property Owner Name(s)

Start-Up Date

Control Panel Model # and UL #

AdvanTex® Model # (if applicable)

AdvanTex® Serial # (if applicable)

NSF/ANSI STANDARD 40

AdvanTex® Treatment System AXN Models meet the requirements of NSF-ANSI Standard 40 for Class I Systems.

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Performance of Textile-Based Packed Bed Filters

Terry R. Bounds P.E.*

Abstract

Small and decentralized wastewater systems may range from individual onsite systems to complete cluster systems. Among the many benefits of onsite and cluster systems is their ability to treat *septic tank* effluent to ***advanced wastewater treatment*** standards (AWT) or better. Many onsite technologies do it more reliably, more affordably, and with considerably less environmental impact than centralized sewers.

For the past couple of decades, packed bed filters (PBFs) — such as single-pass sand filters and recirculating sand and gravel filters — have successfully provided consistent and reliable treatment for small to medium wastewater flows. Textile-based packed bed filters, incorporating an engineered treatment medium, have greatly expanded packed bed technology options by incorporating a manufactured media that is easily serviced and capable of producing high quality effluent. The effluent quality produced by these units is consistently superior to that discharged by the majority of our nation's municipal treatment facilities and is ideal for many water-reuse applications.

Keywords: textile, packed bed filter, decentralized, primary treatment, secondary treatment, advanced wastewater treatment, dispersal, water reuse

Introduction – Packed Bed Filter Technology

Packed bed filters (PBFs) incorporating naturally occurring treatment media such as sand and gravel have been used successfully for treating small to medium volume wastewater flows for decades. These filters produce high quality effluent that is superior to that discharged by the majority of our nation's municipal treatment facilities. Over the past three decades, two types of packed bed sand filters have been most commonly used—the single-pass filter and the recirculating filter. Single-pass sand filters, as illustrated in Figure 1, are capable of treating septic tank effluent to advanced wastewater treatment (AWT) levels or better.

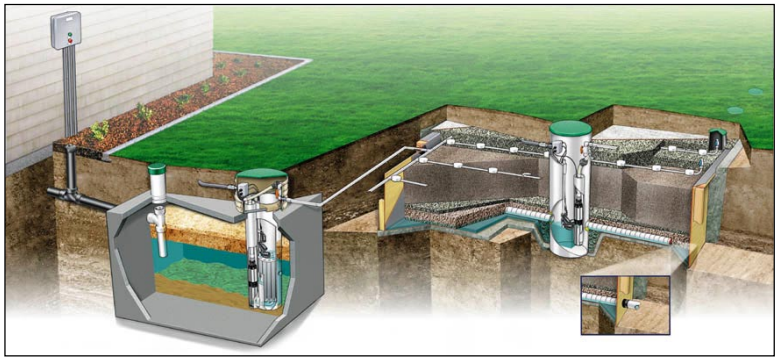


Figure 1: Single-pass sand filter (ISF)

* Executive Vice President, Orenco Systems, Inc., Sutherlin, Oregon

The following effluent characteristics are typical averages achieved by single-pass residential sand filters using "washed" ASTM C-33 concrete aggregate with less than 2 percent fines passing the 100 sieve:

$cBOD_5$: 5 mg/L
TSS: 5 mg/L
NO_3-n: 30 mg/L

Single-pass sand filters have typically been used in onsite applications for single-family homes or small commercial/office facilities.

Single-pass filters have been most successful when the influent has received primary septic tank treatment and screening with effluent filters to sufficiently ensure that the effluent characteristics applied to the sand filter do not exceed the typical criteria shown in Table 1:

Table 1: Typical Primary Treated and Screened Residential Wastewater Strengths

	Average *mg/L*	Weekly Peak *mg/L*	Rarely Exceed *mg/L*
BOD_5	130	200	300
TSS	40	60	150
TKN–n	65	75	150
G&O	20	25	25

With higher influent strengths, maintenance may increase, although with a diligent service and monitoring program, performance is not expected to suffer. Typical single-pass sand filter design criteria are:

Type of Operation	Design Loading Rate *gpd/ft^2*	Filter Depth *inches*	Effective Size *D_{10}, mm*	Uniformity Coefficient *C_u*	Dose Limit *gal/orifice/dose*
Single pass	1.25	24 ±	0.30 ±	3 to 4	0.25

Recirculating (multiple-pass) filters also treat septic tank effluent to advanced wastewater treatment levels or better. Below, in Figure 2, a typical recirculating filter is shown.

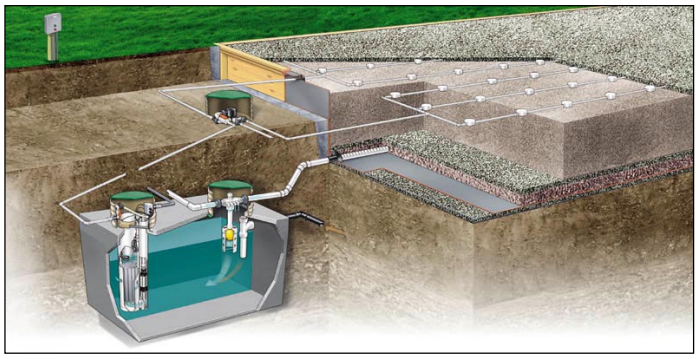


Figure 2: Recirculating sand filter (RSF)

Multiple-pass recirculating sand/gravel filters typically achieve the following average effluent levels:

$cBOD_5$: 10 mg/L
TSS: 10 mg/L
NO_3-n: 30 mg/L

Multiple-pass recirculating sand/gravel filters (RSFs or RGFs) have been most popular in applications with medium to large wastewater flows. They are ideal wastewater treatment systems for parks, restaurants, schools, office complexes, and large developments, and they are especially suited for communities with STEP and/or STEG effluent sewer collection systems. Typical multiple-pass recirculating sand/gravel filter design criteria are:

Type of Operation	Design Loading Rate *gpd/ft²*	Recirc Ratio R:R	Filter Depth *inches*	Effective Size *D_{10}, mm*	Uniformity Coefficient *C_u*	Dose Limit *gal/orifice/dose*
Recirculating	5	5:1	24	1.5 to 2.5	2	0.5 to 1.5

While sand/gravel media PBFs are, and will continue to be, an excellent choice for wastewater pretreatment, certain limitations have prevented them from being considered at all sites:

Land area — Some sites lack the land area required for a sand filter. Single-pass sand filters for single-family homes typically require between 300 and 400 square feet, depending on jurisdictional design or flow criteria.

Media quality and accessibility — Good quality sand media is occasionally not locally available, resulting in either high transportation costs or the use of inferior local media. In addition, getting sand to some sites—such as islands, mountainous regions, or other isolated areas—can be difficult.

Installation quality — Sand filters are typically built onsite with locally available materials, and the quality of installation is partially contingent on the consistency of these materials, and the knowledge and ability of the installing contractor.

Serviceability — The ease of maintaining a buried onsite single-pass sand filter has been a long-term design concern that resulted in robust designs with low loading rates. The low loading rates are intended to ensure 10 to 20 years of continuous usage with little to no intrusive filter maintenance because replacing the sand media can be difficult and costly.

Textile-Based Packed Bed Filters

The efforts to improve loading capacities and serviceability have led to extensive research into a wide variety of media (e.g., foam, glass, styrene, plastic products, expanded clays, zeolite, limestone, furnace slag, peat, etc.). Over the past decade, this research has led to the development of an advanced technology for packed bed filters that uses an engineered textile medium assembled in a variety of configurations. Textile provides all the benefits inherent in the packed bed filter design but overcomes the limitations listed above.

Land area — The land area needed is significantly smaller than that for sand filters because loading rates are 5 to 30 times higher (typically, 15-30 gpd/ft^2 with peak flow capacity/factor (PF) of 2.0 or greater, based on residential effluent quality as described in Tables 1 and 2). Thus, the footprint area for a textile filter serving a typical four-bedroom single-family home is now only about 20 square feet. If the textile filter is positioned over the processing tank, virtually no additional area is required.

Media quality and availability — The manufactured textile medium ensures consistent quality and availability.

Installation quality — Lightweight textile medium (4.0 lb/ft^3) and small filter size make pre-manufactured treatment units practical, eliminating onsite construction and reducing installation time, labor, and construction errors. These characteristics make textile systems ideal for cost-saving self-help programs and particularly suited for difficult-to-access and remotely located sites.

Serviceability — Special configurations allow for ease of maintenance and cleaning without expensive or large excavation equipment, or the need for replacing the medium. A single-family residential filter can now be cleaned and serviced in as little as an hour.

The initial research on the textile medium began with small chips or "coupons" with a complex fiber structure, which offered an extremely large surface area for biomass attachment. Later research has been focused on developing textile filter blends and configurations that address early packed bed filter issues regarding ease of serviceability without sacrificing equivalent performance.

Porosity, attached growth surface area, and water-holding capacity contribute to the textile media's treatment performance.

Porosity — The porosity of the textile media is several times greater than that of sand, gravel, and other particle-type mediums. The more porous the medium, the greater its hydraulic conductivity, the greater its air space (which enhances the capacity of passively ventilated systems and free air movement), and the greater its capacity for the accumulation of solids and biomass development.

Surface area — Textile media can be blended with a variety of fibers to achieve relatively large total surface area per unit volume (ft^2/ft^3). In current media blends, the typical attached-growth surface area is 4-8 times greater than recirculating filter media. Expanding the biomass growth area provides a greater surface potential for air and effluent to interface and come in contact with the biomass.

Water-holding capacity — The water-holding capacity of textile media also varies considerably depending on the media density, type of material, and blend of fibers. The water-holding capacity in textile media is also several times greater than expected in the sands and gravels used in filters. Water-holding capacity performs a key function in the treatment process. Together with the programmed dosing time and frequency, it governs the effluent retention time within the

filter and ultimate effluent quality. In Figure 3, complex fiber structure and void space of textile fibers is compared to that of typical 0.30-mm and 1.5-mm sand particles.

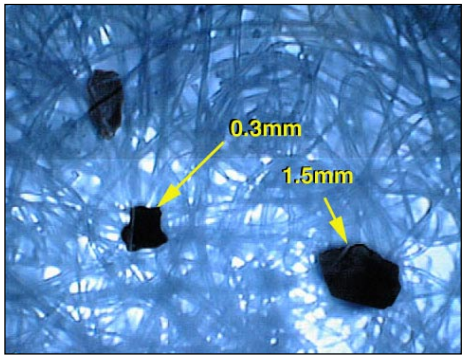


Figure 3: Textile fiber porous structure, relative to sand and gravel particles

Performance of Textile-Based Packed Bed Filters

In the past three years, performance evaluations have been conducted and reported on by facilities such as the University of California, Davis Campus; NSF International; and NovaTec Consultants, Inc. of Vancouver, British Columbia. The University of California Davis study (Leverenz, et al., 2000) was conducted following standard method composite sampling and testing procedures. The evaluations performed by NSF International and NovaTec Consultants (Vassos and Turk, 2002) were conducted per ANSI/NSF Standard 40 protocol. The ANSI/NSF Standard 40 evaluation resulted in the first ever certification of a packed-bed textile filter under ANSI/NSF Standard 40 for Residential Wastewater Treatment Systems. Over the course of the NSF40 evaluation, the average effluent $cBOD_5$ was 5 mg/L and the average effluent TSS was 4 mg/L at a hydraulic loading rate of 29.1 gpd/ft^2. The units evaluated contained vertically aligned textile sheets (AX) as shown in Figure 4. The evaluations successfully established the ability of this configuration to meet advanced wastewater treatment levels and surpassed, by a considerable margin, the effluent quality performance requirements established by ANSI/NSF Standard 40 for Class I effluent.

Figure 4: AX20 AdvanTex® filter with aligned textile sheets

Additional performance evaluation demonstrated the ability of the unit to function under peak design hydraulic and solids-loading conditions for extended periods of time, without service. Over a span of nearly 14 months, NovaTec Consultants (Vassos and Turk, 2002) continuously evaluated performance under peak hydraulic loading conditions (HLR). For 10 of those months, the HLR exceeded 60 gpd/ft^2, and for a period of about 3.5 months the loading rate was 48.3 gpd/ft^2.

During these evaluations, influent organic levels and solids loading levels reached or exceeded peak monthly limits, with daily influent levels reaching highs of 525 mg/L $cBOD_5$ and 1600 mg/L TSS. This demonstrated the resiliency of this unit, under adverse conditions, to consistently produce secondary and advanced treatment quality effluent.

Figure 5 illustrates the relative levels of effluent quality achieved by the three AX units throughout these evaluations. The graph represents over 360 data days of composite sampling over a time span of more than two years.

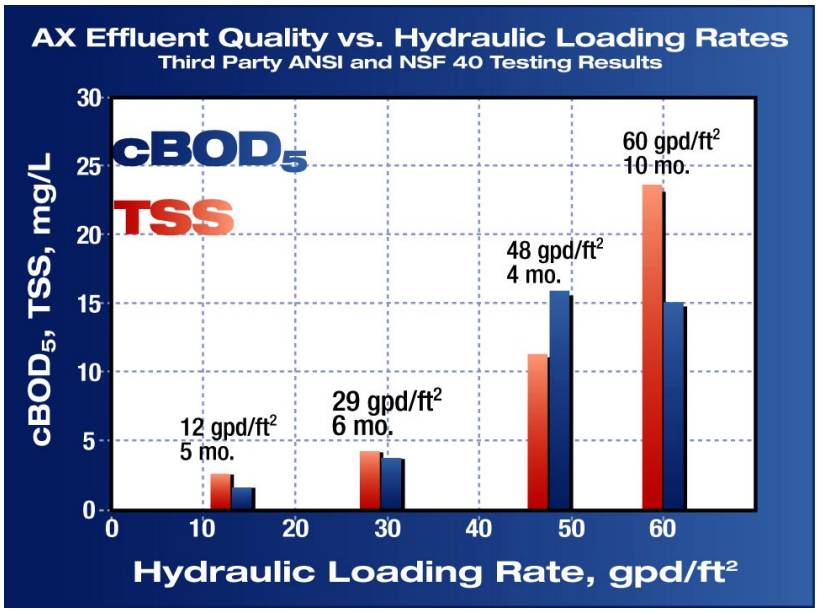


Figure 5: Effluent quality achieved relative to actual hydraulic loading rates

Figures 6a and 6b illustrate the correlation between $cBOD_5$ and TSS removal and direct influent loads, as well as the system's strong removal capacity, overall.

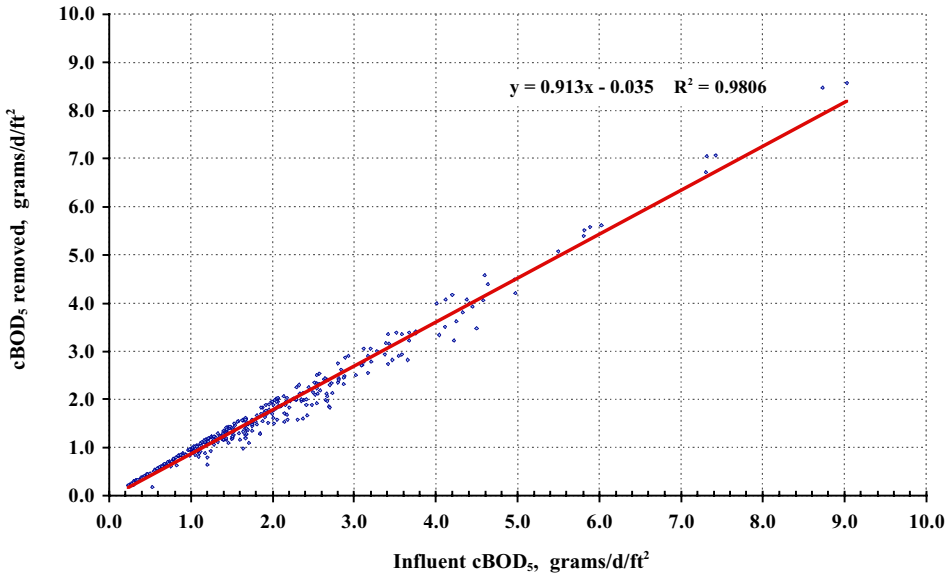


Figure 6a: $cBOD_5$ removal relative to influent loading

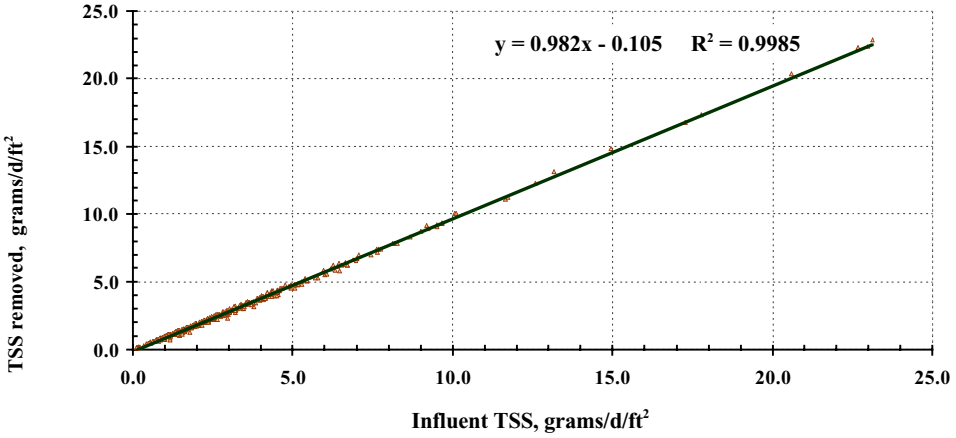


Figure 6b: TSS removal relative to influent loading

Textile filter performance, showing effluent quality consistently better than 10/10 mg/L $cBOD_5$ and TSS has also been documented in several case studies (Bounds/Ball, 2000). Textile filters are currently being used in more than two thousand commercial, cluster, and residential sites across the U.S and Canada.

Additional Attributes of Packed Bed Filters

All small-scale wastewater systems serving individual homes or clusters of homes need to meet the following requirements:

Quick startup
Efficient performance with highly variable wastewater strengths and flows, including occasional hydraulic and biologic overloads
No release of untreated sewage if a malfunction occurs

Consistent trouble-free operation; low maintenance (e.g. annual service call recommended; on-site routine service time 1 hour ±)
Ease of maintenance (components should be easily accessible and serviceable)
Low energy consumption
Adequate storage during power outages (normally 24 hours or more at typical flows)
Recoverable and expandable
Reliability in providing the level of treated water required to final dispersal treatment processes

Packed bed filters are inherently well suited for small-scale wastewater systems. They meet and typically exceed the above-listed requirements, due to the design and operational features described below:

The Role of Watertight Tanks
Watertight septic tanks, which precede PBFs, provide several benefits:

1) Allow primary settling of solids so that the packed bed filter treats largely liquid waste,
2) In conjunction with programmable timer controls, modulate and buffer large and uneven inflow, and
3) Provide emergency storage during power outages or equipment breakdowns. In multiple-pass recirculating PBFs, the recirculation tank provides even more buffering capacity by diluting the incoming septic tank effluent with treated effluent, to mitigate the effects of organic shock loading.

"Fail-safe" design — Most PBF designs do not allow completely untreated sewage to be released since, unlike passive gravity-in/gravity-out systems, wastewater must pass through the treatment media before discharge. This feature also prevents deliberate attempts to disable the treatment system. With passive gravity-in/gravity-out suspended growth aerobic systems, it is not uncommon for users to "unplug" their aeration system to lower their electrical bill. With typical packed bed filters, only the filtrate is discharged, ensuring high effluent quality dispensed for final dispersal.

Flow management — PBF systems with programmable timers in their control panels have the ability to detect excessive inflow caused by infiltration, leaky plumbing fixtures, or higher-than-normal water consumption by the user. This "flow management" provided by the programmable timer is a fundamental tool that allows operators to detect and diagnose problems that would otherwise go undetected until complete system failure. The programmable controllers also provide improved treatment through frequent "micro-dosing" of the PBF.

Speed of startup — The startup capability of PBFs is generally unsurpassable. Since PBFs utilize mechanical filtration as a means of physically removing matter, they are able to achieve high levels of effluent quality within hours of startup. The textile filters evaluated under the testing protocols described earlier demonstrated the ability to remove more than 80% $cBOD_5$ within the first day of operation, and TSS concentrations under 15 mg/L were measured.

Low power requirements — Power costs are low because of the intermittent operation of small fractional horsepower pumps. A typical single-pass PBF for an average single family home only requires 4-12 kWh/mo. At the national average of 8 cents per kWh, the power cost ranges from 32 to

96 cents per month. Depending on the operating recirc-ratio, multiple-pass recirculating PBFs may cost 3 to 5 times more to operate than single-pass PBFs, depending on the operating recirc-ratio.

Low routine maintenance requirements — Annual routine maintenance for PBFs is recommended and normally includes inspection of effluent for clarity (e.g., turbidity, grease and oily films, foam, color, etc.) and odor, as well as cleaning pump filters and flushing distribution piping if necessary. Because PBFs are designed to limit cell mass growth by controlling the organic loading rate and encouraging endogenous respiration, sludge removal is not required from the PBF itself. Solids do build up in the septic tank and must be removed periodically. The pumping of septic tank solids can be as infrequent as every 12 years or more, if solids accumulations are "monitored" every 2-3 years to determine when the tank actually needs pumping.

Ease of maintenance — Maintenance of pre-manufactured, packaged PBF's is particularly service friendly and especially suited for management programs, due to a) Training and certification of installers and service providers, b) Detailed installation and operation manuals that identify specific sevice, testing and troubleshooting techniques, c) Specially engineered mediums, as shown in Figure 9, that can be cleaned with a small pressure washer in the event of system abuse or overuse and put back into service within a matter of minutes, and d) Controls that monitor and alert service providers directly upon electro-mechanical malfunctions, as well as water usage and system functioning abnormalities.

As a result, the management of onsite systems can be as user-friendly, effective, reliable, and trouble-free as the municipal gravity alternative and, in the event of an individual malfunctions, much more manageable and environmentally friendly.

Figure 9: Typical servicing of AdvanTex textile medium. (An underdrain valve is opened during a filter washdown that allows sloughed solids to flush back into the process tank, so there is no removal or wasting of media.)

General Design Considerations

In more than 12 years of research with textile media, several design variations have been tested in both intermittent and recirculating operations and in several different multi-pass recirculating "modes," which optimize nutrient reduction. Like commercial sand and gravel filter installations, commercial textile filter installations are typically operated in multiple-pass recirculating modes. However, unlike residential sand filter installations, which are normally operated as single-pass systems, residential textile technology filters are also configured as multi-pass, recirculating systems, as shown in Figure 7.

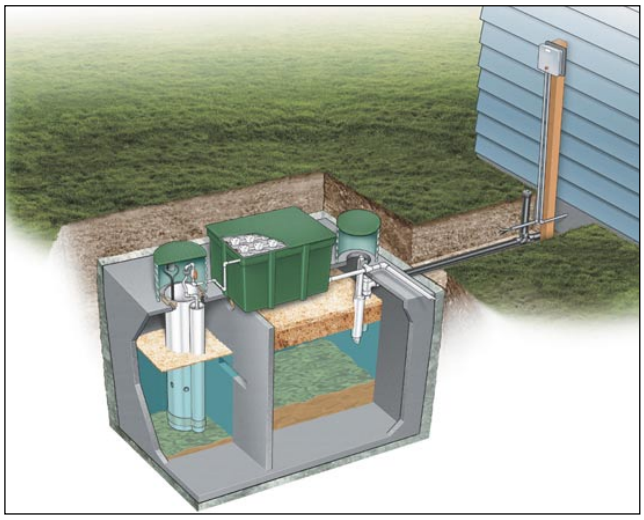


Figure 7: Perspective view of textile filter unit and processing tank system

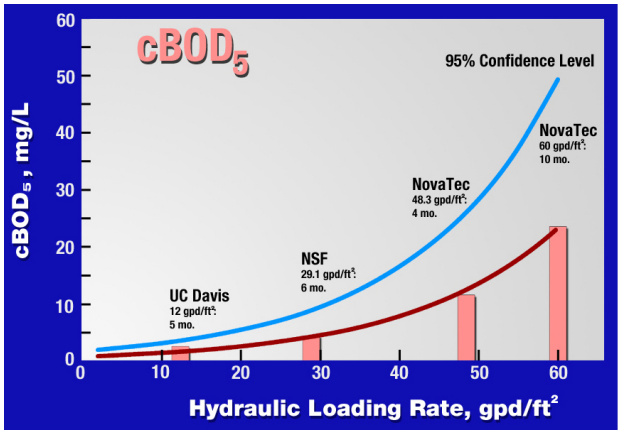
Because the loading rates are dependent on the influent characteristics, a careful and critical evaluation of the contributing source(s) is the first crucial step in adequately accounting for the filter's design size and capacity. Hydraulic, organic, and inorganic inputs (loads) are characteristics that will play critical short and long-term parts in all wastewater treatment designs.

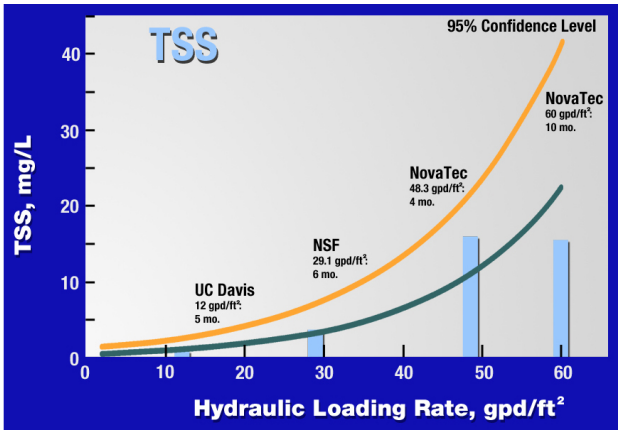
In single-pass applications, it is common to find a screened pump vault located at the outlet of the septic tank, where the septic tank's effluent is drawn from the clear zone of the tank in a decanting manner. The screened effluent is often dosed directly to the single-pass filter. In multiple-pass recirculation processes the clear-zone supernatant discharges into a secondary chamber or tank, which is typically called the recirculation, recirc/blend, or dilution/blend chamber or tank. Typically primary treated effluent from a septic tank *should not average higher than the following parameters, shown in Table 2,* when being further treated by *onsite* filtration and disposal:

Table 2: Typical Residential Wastewater Characteristics

Source	Flow	BOD_5	TSS	Grease	Reference
	gpcd	*mg/L*	*mg/L*	*mg/L*	
Raw Domestic Sewage	*47*	*371*	*338*	*73*	*EPA, M&E Building sewers*
Raw Domestic Sewage	*50*	*450*	*503*	*164*	*Crites-Tchobanoglous, SDWM-1998*
Septic Tank Effluent	*48*	*156*	*84*	*17*	*EPA non-screened ST effluent*
Screened ST Effluent	*60*	*133*	*30*	*n/a*	*Screened ST effluent (12 Communities)*

Designing at 95% confidence levels, as shown in Figure 8a and 8b, tends to ensure reliability in meeting discharge limits consistently within the variability of the occasional excessive loading and operating conditions.





Figures 8a and 8b: AdvanTex® effluent quality relative to hydraulic loading rates, at 95% confidence levels

Conclusion

Test data from residential and commercial packed bed filters incorporating textile media has shown that textile filters provide consistent, high quality wastewater treatment: better than 10/10 $cBOD_5$/TSS. Consequently, they have proven to be an ideal solution in the following, diverse applications:

New onsite wastewater treatment systems
Repairs and reclamation projects
Jurisdictions requiring nutrient reduction
Seasonal or periodically used facilities
Facilities with extreme variations in daily flows
Overloaded single and multiple-pass sand and gravel filters
Wherever water reuse is essential

Moreover, effluent sewers incorporating textile filter treatment units can be used to replace failing conventional collection and treatment systems.

Because textile is lightweight, it can be incorporated into small, affordable, pre-manufactured treatment units. And because the units are modular, they permit easy system expansion in the event of continued over-use or under-design.

Orenco's AdvanTex® brand textile packed bed filters have made a major impact in addressing user, environmental, and management issues relating to onsite wastewater treatment. Like many onsite technologies, AdvanTex® brand textile packed bed filters treat wastewater more reliably, more affordably, and with considerably less environmental impact than centralized sewers do. With designers, regulators, distributors, installers, maintenance personnel, and users all working together to deliver a high quality, highly serviceable product, textile packed bed filters can help us take a significant step towards demonstrating the viability of decentralized and onsite systems.

References

ADEQ-YCES Aerobic Systems Survey, 1997. Prescott, AZ.

Bounds, T., E. Ball, and H. Ball, 2000. Performance of Packed Bed Filters. Southwest Conference, Arizona Environmental Health Association. Laughlin, NV.

Crites, R. and G. Tchobanaglous, 1998. Small and Decentralized Wastewater Management Systems. WCB McGraw-Hill.

Leverenz, H., J. Darby, and G. Tchobanoglous, 2000. Evaluation of Textile Filters for the Treatment of Septic Tank Effluent. Center for Environmental and Water Resources Engineering, Department of Civil and Environmental Engineering. University of California, Davis, CA.

NSF International, 2002. ANSI/NSF Standard 40 Residential Wastewater Treatment System evaluation report.

Roy, C., R. Auger, and R. Chenier, 1998. Use of Non-Woven Fabric in Intermittent Filters. Proceedings of the Eighth National Symposium on Individual and Small Community Sewage Systems. American Society of Agricultural Engineers. St. Joseph, MI.

Vassos, T. and O.S. Turk, 2002. Technology Verification Report, Orenco–AdvanTex™ Model AX10 Onsite Treatment System. NovaTec Consultants Inc., Vancouver, B.C. Canada.

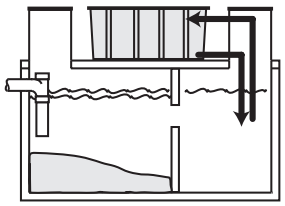
AdvanTex® Performance Summary #1

General Reduction: $CBOD_5$, TSS, FC

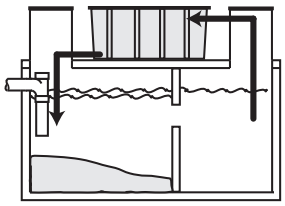
AdvanTex® Treatment Systems — Manufactured by Orenco Systems®, Inc.

Since 2001, the performance of AdvanTex® Treatment Systems has been tested in a dozen different programs. Tests have been performed both in test centers and in the field. These include testing performed by outside companies or agencies (third-party); contract testing performed by Orenco distributors (second-party); and Orenco's own testing (first-party).

This performance summary documents the performance of AdvanTex Treatment Systems relative to reduction of BOD_5, TSS, and Fecal Coliform. The results show that AdvanTex systems easily meet advanced treatment standards for these parameters.



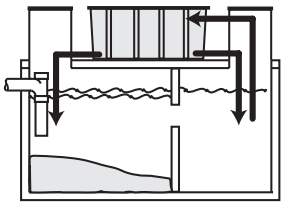
Mode 1



Mode 3

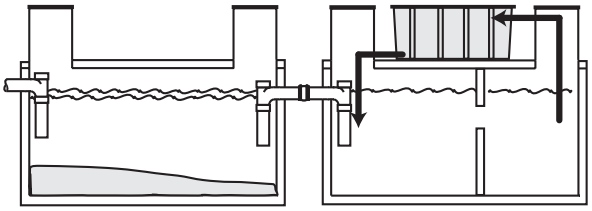
About System Configurations

As shown in the illustrations on the right, AdvanTex systems can be configured in different ways, depending on the degree of total nitrogen required. In Mode 1 (top left illus), filtrate from the AdvanTex pod is recirculated to the secondary chamber of the septic tank. In Mode 3 (top right illus), filtrate is recirculated to the primary chamber, where the environment favors further nitrogen reduction. See *AdvanTex Performance Summary — Nutrient Reduction* for TN, NH_3, and TP results (AHO-ATX-PERF-TN-1).



Combo Mode

In the Combo Mode (center illus), filtrate from the AdvanTex pod is recirculated to both chambers. There is also a Mode 1 configuration (bottom illus) that uses a primary tank and a recirculation tank. In the primary tank, sludge and scum are separated from liquid effluent, which then flows into a separate recirculation tank, into which the AdvanTex filtrate is recirculated.



Mode 1 with primary tank and recirculation tank

About the Results

The table below summarizes effluent testing results for $CBOD_5$, TSS, Turbidity, and Fecal Coliform, both from test center programs and field testing programs. The pages that follow provide more specific results of these testing programs. For ease of comparison, we have also included information about the circumstances of each test. If you have any questions regarding this summary, please contact Sam Carter, Government Relations Manager, Orenco Systems, Inc., (800) 536-4192, scarter@orenco.com.

TEST CENTERS

AdvanTex Effluent Averages	*$cBOD_5$ (mg/L)*	*TSS (mg/L)*	*Turbidity (ntu)*	*FC* (mpn/100ml)*	*Duration*
NSF/ANSI Standard 40 Testing	5	4	4	-	6 months
NSF/ANSI Standard 40 Testing with UV Disinfection	4	6	1.2	$1.35x10^4$ (1.7)**	7 months
Rotorua District Council Approval Testing	2	3	-	$1.2x10^4$	9 months
NovaTec Consultants, Inc. Start-up Testing	20	5	9.0	-	1 week

FIELD TESTING

*AdvanTex Effluent Averages (# of SFRs)****	*$cBOD_5$ (mg/L)*	*TSS (mg/L)*	*Turbidity (ntu)*	*FC* (units vary)*	*Duration*
Roger Shafer, P.E., "Testing in Fractured Bedrock" (1)	5	6	-	$4.5x10^3$	8 months
Virginia Approval Testing Program (18)	7	9	2	$7.8x10^2$	18 months
Pennsylvania Testing Program (11)	6	10	7	$9.5x10^2$	1-3 years
Skaneateles Demonstration Project (2)	4	3	1	$3.5x10^2$	2 years
La Pine National Demonstration Project (3)	9	6	-	$9.9x10^3$	2 years, 7 months
Green Hill Pond Watershed Demonstration Project (5)	8	5	-	$1.9x10^3$	1 year, 4 months
North Carolina Approval Testing Program- (>50)****	7	6	-	-	4 years

** FC sample taken following AdvanTex treatment. Fecal Coliform figured as a geometric mean*
*** FC sample taken following UV unit. Fecal Coliform figured as a geometric mean*
**** sfr = Single-family residences*
***** Includes single-family residences and vacation rentals*

TEST CENTERS

NSF/ANSI Standard 40 Testing

(Third-Party)

About the Testing: Orenco contracted with Novatec to test an AX20 Mode 1 system in support of its application for NSF approval. Novatec conducts official NSF/ANSI Standard 40 testing under contract to manufacturers at its facility in Squamish, British Columbia. Testing is done at a wastewater facility that serves a residential subdivision. Composite sampling was used throughout this evaluation.

Dates: May 2001-November 2001

Location: British Columbia

Average Daily Flow: 500 gpd

System Configuration: AX20 Mode 1 recirculating into the second compartment of a 1500-gallon tank

Processing Tank Influent

	BOD_5 (mg/L)	TSS (mg/L)
Mean	162	291
Median	130	200
Number of Samples	102	108

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Turbidity (NTU)
Mean	**5**	**4**	**4**
Median	3	3	4
Number of Samples	109	109	117*
Percent Reduction	97%	99%	-

** Samples taken during stress periods*

NSF/ANSI Standard 40 Testing with UV Disinfection

(Third-Party)

About the Testing: Orenco contracted with Novatec to test an AX20N Mode 1 system with UV disinfection to determine its capabilities for reducing fecal coliform. Novatec conducts official NSF/ANSI Standard 40 testing under contract to manufacturers at its facility in Squamish, British Columbia. Although the NSF/ANSI Standard 40 protocol does not require it, Orenco elected to sample for total nitrogen. Testing is done at a wastewater facility that serves a residential subdivision.

Dates: July 2006-December 2006

Location: British Columbia

Average Daily Flow: 500 gpd

System Configuration: AX20 Mode 1 recirculating into the second compartment of a 1500-gallon tank with UV disinfection

Processing Tank Influent

	BOD_5 (mg/L)	TSS (mg/L)	FC (cfu/100 mL)
Mean	180	210	$3.37x10^{6}$*
Median	170	190	-
Number of Samples	136	136	80

** Calculated as a geometric mean*

AdvanTex Effluent

	$cBOD_5$*	TSS*	FC**	FC / UV***	Turbidity****
Mean	**4**	**6**	**$1.35x10^{4}$**	**1.7**	**1.2**
Median	3	4	-	-	0.9
Number of Samples	25	25	72	78	77
Percent Reduction	98%	97%	-	-	

* *mg/L*
** *FC sample taken following AdvanTex treatment. Fecal Coliform figured as a geometric mean*
*** *FC sample taken following UV unit. Fecal Coliform figured as a geometric mean*
**** *Turbidity (NTU)*

Rotorua District Council Approval Testing

(Third-Party)

About the Testing: Testing of residential wastewater treatment systems was initiated by the Rotorua District Council and Environment Bay of Plenty, the Regional Council. The purpose of the project was to compare systems so that manufacturers that meet their specifications can be preapproved. The one-year trial was focused particularly on nitrogen reduction, and includes "stress testing" and vacation simulation as well as monitoring of each system's power usage.

Dates: June 2005-August 2006

Location: New Zealand

Average Daily Flow: 265 gpd

System Configuration: Mode 3 recirculating into the primary compartment of a 1500-gallon processing tank.

Processing Tank Influent

	$cBOD_5$ (mg/L)	TSS (mg/L)	FC (col/100 mL)
Mean	229	341	$6.8x10^{6}$
Median	233	318	$8.6x10^{6}$
Number of Samples	52	52	50

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	FC (col/100 mL)
Mean	**2**	**3**	**$1.2x10^{4}$***
Median	2	2	$2.7x10^{4}$
Number of Samples	52	52	52
Percent Reduction	99%	99%	99.8%

** Calculated as a geometric mean*

Start-up Testing Novatec Consultants, Inc.

(Third-Party)

About the Testing: This was part of Orenco's NSF/ANSI Standard 40 official testing, conducted by Novatec. The Standard 40 protocol allows a start-up period of three weeks. We elected to start testing within *three days* of startup. Below is the average performance for the first five days following start-up. Composite sampling was used throughout this evaluation.

Dates: May 2001

Location: British Columbia

Average Daily Flow: 500 gpd

System Configuration: AX20 Mode 1 recirculating into the second compartment of a 1500-gallon processing tank

Processing Tank Influent

	BOD_5 (mg/L)	TSS (mg/L)	Turbidity (NTU)
Mean	200	273	-
Number of Samples	3	3	-

AdvanTex Effluent

	$cBOD_5$ (mg/L)	TSS (mg/L)	Turbidity (NTU)
Mean	**20**	**5**	**9**
Number of Samples	3	3	3
Percent Reduction	90%	98%	-

FIELD TESTING

Roger Shafer, P.E., Testing in Fractured Bedrock*

(Second-Party)

About the Testing: This test involved one AdvanTex system at a single-family home.

Dates: Summer 2001, Winter 2002, Winter 2007/2008

Location: Colorado

Average Daily Flow: 209 gpd (April 2001 and August 2001)

System Configuration: This system consisted of two AX10s (which together have the same treatment capacity as an AX20), configured in Mode 3, recirculating to the primary compartment of a 1500-gallon processing tank.

*Septic Tank Effluent***

	BOD_5 (mg/L)	*TSS (mg/L)*	*FC (col/100 mL)*
Mean	154	96	>10,000
Number of Samples	5	5	5

AdvanTex Effluent

	BOD_5 (mg/L)	*TSS (mg/L)*	*FC (col/100 mL)*
Mean	**5**	**6**	**$2.0x10^3$**
Number of Samples	13	13	13
Percent Reduction	97%	94%	-

** Roger Shafer, "Use of a Recirculating Textile Filter followed by a Polishing Sand Filter for Onsite Wastewater Treatment in Colorado's Fractured Bedrock Environment," presented at the Colorado Professional Onsite Wastewater 2008 Education Conference.*

***Five septic tank effluent samples were collected from the system between April and May 2001 using a 3/4-in. clear plastic tank sampler. Samples were collected from the outlet tee of the septic tank before installation of the AdvanTex system.*

Virginia Approval Testing Program

(Third-Party)

About the Testing: Conducted by Mark Gross, P.E., Ph.D., of the University of Arkansas Department of Civil Engineering, this testing program involved AX20 systems installed at 18 single-family homes, which were sampled for 18 months.

Dates: October 2002-2006

Location: Virginia

Average Daily Flow: 90-308 gpd

System Configuration: AX20 Mode 1 (4 sites) recirculating into a recirculating tank located after a separate primary septic tank; AX20 Mode 3 (14 sites) recirculating into the primary compartment of a 1500-gallon processing tank.

Mode 3 Systems, AdvanTex Effluent

	*$cBOD_5$ **	*TSS**	*Turbidity (NTU)*	*E. Coli***
Mean	**7**	**9**	**2**	**$7.8x10^{2}$*****
Median	3	5	1	**$1.1x10^3$**

** mg/L*
*** mpn/100ml*
**** Calculated as a geometric mean*

Pennsylvania Testing Program

(Third-Party)

About the Testing: This test was performed as required by the State of Pennsylvania under its Technology Verification Program. NSF International is the third party that was contracted with to oversee the testing. The test involved AX20 systems installed at 11 single-family homes.

Dates: September 2005-2008

Location: Pennsylvania

Average Daily Flow: 100-300 gpd

System Configuration: AX20 Combo Mode recirculating into the primary compartment and secondary compartment of a 1500-gallon processing tank.

Processing Tank Influent

	*$cBOD_5$ **	*TSS**	*Turbidity (NTU)*	*FC (col/100ml)*
Mean	130	180	140	$3.7x10^4$
Median	110	50	45	$8.2x10^4$
No. of Samples	89	89	88	88

AdvanTex Effluent

	*$cBOD_5$ **	*TSS**	*Turbidity (NTU)*	*FC (col/100ml)*
Mean	**6**	**10**	**7**	**$9.5x10^2$**
Median	4	5	3	$6.1x10^2$
Number of Samples	211	211	213	82
Percent Reduction	95%	94%	95%	97%

** mg/L*

Skaneateles Demonstration Project

(Third-Party)

About the Testing: This testing was performed as part of the Skaneateles Demonstration Project. The purpose of this project was to evaluate the performance and management of innovative technologies on single-family residences. As part of this project, two AX20 systems were installed at a single-family residence and tested.

Dates: November 2004-November 2006

Location: New York

Average Daily Flow: 106 gpd

System Configuration: AX20 Mode 1 recirculating into the second compartment of a 1500-gallon processing tank.

Mode 1 Systems, AdvanTex Effluent

	*$cBOD_5$ **	*TSS**	*Turbidity (NTU)*	*FC (col/100ml)*
Mean	**4**	**3**	**1**	$3.5x10^{2}$**
Median	2	2	1	$9.2x10^2$
Number of Samples	18	18	18	18

** mg/L*
*** Calculated as a geometric mean*

La Pine National Demonstration Project

(Third-Party and First-Party)

About the Testing: This project is a cooperative effort by the Deschutes County Environmental Health Division, the Oregon Department of Environmental Quality, and the U.S. Geological Survey. The purpose of the project is to evaluate innovative denitrification technologies in an area of the state where climate and soil conditions are unfavorable for denitrification and the risk of groundwater contamination is high. As part of the project, three AX20 systems were installed at single-family residences. In addition to the samples required for the project, some samples were collected by Orenco.

Dates: January 2002-July 2004

Location: Oregon

Average Daily Flow: 108-334 gpd

System Configuration: AX20 Mode 3 recirculating into the primary compartment of a 1500-gallon processing tank.

*Septic Tank Effluent**

	BOD_5 (mg/L)	*TSS (mg/L)*	*FC (col/100 mL)*
Mean	261	94	2.3×10^{5}*
Median	240	62	1.9×10^{5}
Number of Samples	428	427	429

**Average of all other sites where septic tank effluent is being sampled*

Mode 3 Systems, AdvanTex Effluent

	BOD_5 (mg/L)	*TSS (mg/L)*	*FC (mpn/100 mL)*
Mean	**9**	**6***	**9.9×10^{3} ***
Median	5	3	8.8×10^{3}
Number of Samples	92	94	67

** Calculated as a geometric mean*

Green Hill Pond Watershed Demonstration Project

(Third-Party)

About the Testing: The University of Rhode Island Cooperative Extension On-Site Wastewater Training Center constructed and is testing several innovative septic systems, including five AdvanTex systems, in the Green Hill Pond Watershed. The Training Center is evaluating the systems' performance and using the installations to train installers, homeowners, designers, and regulators.

Dates: August 2003-December 2004

Location: Rhode Island

System Configuration: The project includes five AX20s at single-family homes, all configured as Mode 3, recirculating into the primary compartment of a 1500-gallon processing tank.

Mode 3 Systems, AdvanTex Effluent

	$cBOD_5$ (mg/L)	*TSS (mg/L)*	*FC (col/100 mL)*
Mean (all sites)	**8**	**5**	**1.9×10^{3}***
Median	4	2	1.0×10^{3}
Number of Samples	21	24	24

** Calculated as a geometric mean*

North Carolina Approval Testing Program

(Second-Party)

About the Testing: This testing, conducted under state oversight, involves more than 50 AdvanTex systems at single-family homes and vacation rentals. The data include results from both AX20 and AX100 systems.

Dates: August 2003-present

Location: North Carolina

Average Daily Flow: 75-2200 gpd

System Configuration: AX20 Mode 1 and Mode 3 and AX100. Except for one system, all were configured as Mode 1 with recirculation into a recirculation tank located after a separate primary septic tank. A single system was configured as Mode 3 with a single processing tank.

AdvanTex Effluent

	$cBOD_5$ (mg/L)	*TSS (mg/L)*
Mean	**7**	**6**
Median	3	4
Number of Samples	200	198

AdvanTex® Performance Summary #2

Nutrient Reduction: TN, NH_3, TP

AdvanTex® Treatment Systems — Manufactured by Orenco Systems®, Inc.

Since 2001, the performance of AdvanTex® Treatment Systems has been tested in a dozen different programs. Tests have been performed both in test centers and in the field. These include testing performed by outside companies or agencies (third-party); contract testing performed by Orenco distributors (second-party); and Orenco's own testing (first-party). More than 1000 data points have been collected.

This performance summary documents the performance of AdvanTex Treatment Systems relative to nutrient reduction . . . specifically, reductions in Total Nitrogen (TN), Ammonia (NH_3), and Total Phosphorous (TP). The results show that AdvanTex systems easily meet advanced treatment standards for nitrogen and total phosphorous.

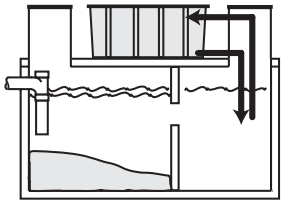
About System Configurations

As shown in the illustrations on the right, AdvanTex systems can be configured in several ways depending on the degree of total nitrogen reduction required. In Mode 1, filtrate from the AdvanTex pod is recirculated to the secondary chamber of the septic tank. In Mode 3, the filtrate is recirculated to the primary chamber, where the environment favors further denitrification. In Combo mode, the filtrate is recirculated to both chambers, in controlled proportions.

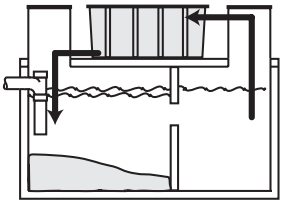
In Virginia, North Carolina, and Rhode Island, some of the systems tested in Mode 1 incorporated two tanks: a primary tank and a recirculation tank. In the primary tank, sludge and scum are separated from liquid effluent, which then flows into a separate recirculation tank, into which the AdvanTex filtrate is recirculated.

About the Results

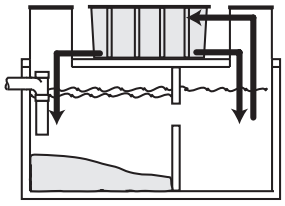
The table below summarizes effluent testing results for Total Nitrogen, Ammonia, and Total Phosphorous, both from test center programs and field testing programs. The pages that follow provide more specific results of these testing programs. For ease of comparison, we have also included information about the circumstances of each test. If you have any questions regarding this summary, please contact Sam Carter, Government Relations Manager, Orenco Systems, Inc., (800) 536-4192, scarter@orenco.com.



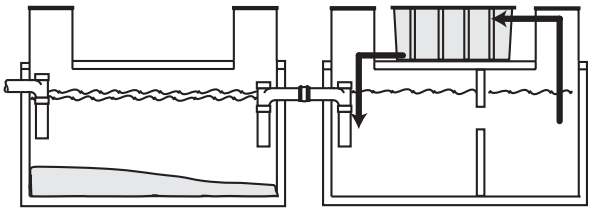
Mode 1 with processing tank



Mode 3 with processing tank
(Optimized for denitrification)



Combo Mode with processing tank



Mode 1 with primary tank and recirculation tank

TEST CENTERS SUMMARY

AdvanTex Effluent Averages	*Total N (mg/L)* [1]	*NH_3 (mg/L)*	*Total P (mg/L)*	*Duration*
NSF/ANSI Standard 40 Testing	12 (64%)[2]	0.9 (96%)	-	7 months
NSF/ANSI Standard 40 Testing with UV Disinfection	13 (66%)	1.1	-	6 months
Novatec Nitrogen Removal Testing	10 (70%)	-	-	1 year
Rotorua District Council Approval Testing	13 (82%)	0.2 (99%)	8 (33%)	13 months

FIELD TESTING SUMMARY

AdvanTex Effluent Averages (# of SFRs) [3]	*Total N (mg/L)*	*NH_3 (mg/L)*	*Total P (mg/L)*	*Duration*
Roger Shafer, P.E., "Testing in Fractured Bedrock" (1)	14 (63%)	-	6 (33%)	8 months
NSF Pennsylvania Testing Program (11)	17 (68%)	1.7 (96%)	-	1-3 years
Virginia Approval Testing Program (13)	15	1.8	-	18 months
Jefferson County Health Dept. Permit Testing (43)	15	-	-	2 years, 7 months
Skaneateles Demonstration Project (2)	14	0.9	10	2 years, 2 months
La Pine National Demonstration Project (3)	17 (74%)	1.9	9 (18%)	2 years, 7 months
Rhode Island Demonstration Project (5)	18	-	9	1 year, 4 months
North Carolina Approval Testing Program— Mode 1 (14)[4]	26 (63%)	-	-	2 years, 10 months
North Carolina Approval Testing Program — Mode 3 (1)	15	-	-	2 years, 10 months

[1] TN = TKN + NO_3-N + NO_2-N

[2] Percent Reduction

[3] SFR = Single-family residences

[4] Includes single-family residences and vacation rentals

TEST CENTERS

NSF/ANSI Standard 40 Testing

(Third-Party)

About the Testing: Orenco contracted with Novatec to test an AX20 Mode 1 system in support of its application for NSF approval. Novatec conducts official NSF/ANSI Standard 40 testing under contract to manufacturers at its facility in Squamish, British Columbia. Although the NSF/ANSI Standard 40 protocol does not require it, Orenco elected to sample for total nitrogen.

Testing is done at a wastewater facility that serves a residential subdivision. Composite sampling was used throughout this evaluation.

Dates: August 2001-February 2002*

Location: British Columbia

Average Daily Flow: 500 gpd

System Configuration: AX20 Mode 1 recirculating into the second compartment of a 1500-gallon tank

*Note: Nitrogen results are from July to February, which allows for a two-month start-up period.

Processing Tank Influent

	Total N (mg/L)	*NH_3 (mg/L)*
Mean	**34**	**22**
Median	33	23
Number of Samples	21	21

AdvanTex Effluent

	Total N (mg/L)	*NH_3 (mg/L)*
Mean	**12**	**0.9**
Median	13	0.6
Number of Samples	27	19
Percent Reduction	64%	96%

NSF/ANSI Standard 40 Testing with UV Disinfection

(Third-Party)

About the Testing: Orenco contracted with Novatec to test an AX20N Mode 1 system with UV disinfection to determine its capabilities for reducing fecal coliform. Novatec conducts official NSF/ANSI Standard 40 testing under contract to manufacturers at its facility in Squamish, British Columbia. Although the NSF/ANSI Standard 40 protocol does not require it, Orenco elected to sample for total nitrogen.

Testing is done at a wastewater facility that serves a residential subdivision. Composite sampling was used throughout this evaluation.

Dates: July 2006-December 2006

Location: British Columbia

Average Daily Flow: 500 gpd

System Configuration: AX20 Mode 1 recirculating into the second compartment of a 1500-gallon tank with UV disinfection

Note: See *AdvanTex Performance Summary — General Reduction (AHO-ATX-PERF-1)* for fecal coliform results.

Processing Tank Influent

	TKN (mg/L)
Mean	**38**
Median	40
Number of Samples	22

AdvanTex Effluent

	Total N (mg/L)	*NH_3 (mg/L)*
Mean	**13**	**1.1**
Median	12	0.6
Number of Samples	20	22
Percent Reduction	66%	-

Novatec Consultants, Inc. Nitrogen Removal Testing

(Third-Party)

About the Testing: After completion of the NSF/ANSI Standard 40 testing, Orenco contracted with Novatec to evaluate denitrification performance of the same AX20 system in Mode 3. Composite sampling was used throughout this evaluation.

Dates: December 2002-December 2003

Location: British Columbia

Average Daily Flow: 250 gpd

System Configuration: AX20 Mode 3 recirculating into the primary compartment of a 1500-gallon processing tank

Processing Tank Influent

	Total N (mg/L)
Mean	**33**
Median	33
Number of Samples	5

AdvanTex Effluent

	Total N (mg/L)
Mean	**10**
Median	10
Number of Samples	25
Percent Reduction	70%

Rotorua District Council Approval Testing

(Third-Party)

About the Testing: Testing of residential wastewater treatment systems was initiated by the Rotorua District Council and Environment Bay of Plenty, the Regional Council. The purpose of the project was to compare systems so that manufacturers that meet their specifications can be preapproved. The 13-month trial was focused particularly on nitrogen reduction.

Dates: May 2005-June 2006*

Location: New Zealand

Average Daily Flow: 265 gpd

System Configuration: Mode 3 recirculating into the primary compartment of a 1500-gallon processing tank.

* Note: Nitrogen results are from September to June, which allows for a four-month start-up period (starting in winter).

Processing Tank Influent

	Total N (mg/L)	*NH_3 (mg/L)*	*Total P (mg/L)*
Mean	**72**	**49**	**12**
Median	71	49	12
Number of Samples	-	-	-

(Continued on next page)

(Continued from Page 2)

AdvanTex Effluent

	Total N (mg/L)	NH_3 (mg/L)	Total P (mg/L)
Mean	**13**	**0.2**	**8**
Median	13	0.2	8
Number of Samples	41	-	-
Percent Reduction	82%	99%	33%

FIELD TESTING

Roger Shafer, P.E., Testing in Fractured Bedrock*

(Second-Party)

About the Testing: This test involved one AdvanTex system at a single-family home.

Dates: Summer 2001, Winter 2002, Winter 2007/2008

Location: Colorado

Average Daily Flow: 209 gpd (April 2001 and August 2001)

System Configuration: This system consisted of two AX10s (which together have the same treatment capacity as an AX20), configured in Mode 3, recirculating to the primary compartment of a 1500-gallon processing tank.

Septic Tank Effluent**

	Total N (mg/L)	Total P (mg/L)
Mean	**38**	**9**
Number of Samples	5	5

AdvanTex Effluent

	Total N (mg/L)	Total P (mg/L)
Mean	**14**	**6**
Number of Samples	13	13
Percent Reduction	63%	33%

** Roger Shafer, "Use of a Recirculating Textile Filter followed by a Polishing Sand Filter for Onsite Wastewater Treatment in Colorado's Fractured Bedrock Environment," presented at the Colorado Professional Onsite Wastewater 2008 Education Conference.*

*** Five septic effluent samples were collected from the system between April and May 2001 using a 3/4-in. clear plastic tank sampler. Samples were collected from the outlet tee of the septic tank before installation of the AdvanTex system.*

Pennsylvania Testing Program

(Third-Party)

About the Testing: This test was performed as required by the State of Pennsylvania under its Technology Verification Program. NSF International is the third party that was contracted with to oversee the testing. The test involved AX20 systems installed at 11 single-family homes.

Dates: September 2005-2008

Location: Pennsylvania

Average Daily Flow: 100-300 gpd

System Configuration: AX20 Combo Mode recirculating into the primary compartment and secondary compartment of a 1500-gallon processing tank.

Processing Tank Influent

	Total N (mg/L)	NH_3 (mg/L)
Mean	**54**	**42**
Median	43	31
Number of Samples	42	38

AdvanTex Effluent

	Total N (mg/L)	NH_3 (mg/L)
Mean	**17**	**1.7**
Median	16	0.6
Number of Samples	212	213
Percent Reduction	68%	96%

Virginia Approval Testing Program

(Third-Party)

About the Testing: Conducted by Mark Gross, P.E., Ph.D., of the University of Arkansas Department of Civil Engineering, this testing program involved AX20 systems installed at 13 single-family homes, which were sampled for 18 months.

Dates: October 2002-2006

Location: Virginia

Average Daily Flow: 90-308 gpd

System Configuration: AX20 Mode 1 (1 site) recirculating into a recirculating tank located after a separate primary septic tank; AX20 Mode 3 (12 sites) recirculating into the primary compartment of a 1500-gallon processing tank.

AdvanTex Effluent

	Total N (mg/L)	NH_3 (mg/L)
Mean	**15**	**1.8**
Median	12	0.4
Number of Samples	84	84

Jefferson County Health Department Operating Permit Testing

(Second-Party)

About the Testing: Orenco distributor Roger Shafer sampled 43 systems at single-family residences as required by the Jefferson County (Colorado) Health Department as an operating permit requirement.

Dates: October 2003-May 2006

Location: Colorado

System Configuration: Four AX20 systems and thirty-nine AX30 (AX20 and AX10) systems were all configured as Mode 3, recirculating into the primary compartment of a processing tank.

AdvanTex Effluent*	AX30	AX20
	Total N (mg/L)	Total N (mg/L)
Mean	**15**	**15**
Median	16	14
Number of Samples	124	16

** For the 41 sites that have more than one sample*

Skaneateles Demonstration Project

(Third-Party)

About the Testing: This testing was performed as part of the Skaneateles Demonstration Project. The purpose of this project was to evaluate the performance and management of innovative technologies on single-family residences. As part of this project, two AX20 systems were installed at single-family residences and tested.

Dates: November 2004-January 2007

Location: New York

Average Daily Flow: 106 gpd

System Configuration: AX20 Mode 1 recirculating into the second compartment of a 1500-gallon processing tank.

Mode 1 Systems, AdvanTex Effluent

	Total N (mg/L)	*NH3 (mg/L)*	*Total P (mg/L)*
Mean	**14**	**0.9**	**10**
Median	14	0.9	10
Number of Samples	18	18	18

La Pine National Demonstration Project

(Third-Party and First-Party)

About the Testing: This project is a cooperative effort by the Deschutes County Environmental Health Division, the Oregon Department of Environmental Quality, and the U.S. Geological Survey. The purpose of the project is to evaluate innovative denitrification technologies in an area of the state where climate and soil conditions are unfavorable for denitrification and the risk of groundwater contamination is high. As part of the project, three AX20 systems were installed at single-family residences. In addition to the samples required for the project, some samples were collected by Orenco.

Dates: January 2002-July 2004

Location: Oregon

Average Daily Flow: 108-334 gpd

System Configuration: AX20 Mode 3 recirculating into the primary compartment of a 1500-gallon processing tank.

Septic Tank Effluent*

	Total N (mg/L)	*NH_3 (mg/L)*	*Total P (mg/L)*
Mean	**66**	**-**	**11**
Median	63	-	10
Number of Samples	427	-	429

** Average of all other sites when the septic tank effluent is being sampled.*

Mode 3 Systems, AdvanTex Effluent

	Total N (mg/L)	*NH_3 (mg/L)*	*Total P (mg/L)*
Mean	**17**	**1.9**	**9**
Median	16	0.8	9
Number of Samples	57	57	68
Percent Reduction	74%	-	18%

Rhode Island Demonstration Project — Green Hill Pond Watershed

(Third-Party)

About the Testing: The University of Rhode Island Cooperative Extension On-Site Wastewater Training Center constructed and is testing several innovative septic systems, including five AdvanTex systems, in the Green Hill Pond Watershed. The Training Center is evaluating the systems' performance and using the installations to train installers, homeowners, designers, and regulators.

Dates: August 2003-December 2004

Location: Rhode Island

System Configuration: The project includes five AX20s at single-family homes, all configured as Mode 3, recirculating into the primary compartment of a 1500-gallon processing tank.

Mode 3 Systems, AdvanTex Effluent

	Total N (mg/L)	*Total P (mg/L)*
Mean (all sites)	**18**	**9**
Median	17	10
Number of Samples	24	24

North Carolina Approval Testing Program

(Second-Party)

About the Testing: This test, conducted under state oversight, involves 15 AdvanTex systems at single-family homes and vacation rentals. The data include results from both AX20 and AX100 systems.

Dates: August 2003-June 2006

Location: North Carolina

Average Daily Flow: 75-2200 gpd

System Configuration: AX20 Mode 1 and Mode 3 and AX100. Except for one system, all were configured as Mode 1 with recirculation into a recirculation tank located after a separate primary septic tank. A single system was configured as Mode 3 with a single processing tank.

Mode 1 Systems, Septic Tank Effluent

	TKN (mg/L)
Mean	**66**
Median	68
Number of Samples	26

Mode 1 Systems, AdvanTex Effluent

	Total N (mg/L)
Mean	**26**
Median	25
Number of Samples	95
Percent Reduction	63%

Mode 3 Systems, AdvanTex Effluent

	Total N (mg/L)
Mean	**15**
Median	13
Number of Samples	5